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METHODS FOR SCOPING ENVIRONMENTAL IMPACT ASSESSMENTS
A REVIEW OF LITERATURE AND EXPERIENCE

Prepared for the
Federal Environmental Assessment Review Office
Vancouver, B.C.

by
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1. INTRODUCTION

1.1 PURPOSE

Environmental scoping is a process for deciding which issues should be considered in an environmental impact assessment (EIA). This report is a comprehensive review of published literature on environmental scoping. It documents procedures, techniques and methods for environmental scoping as described in published journals, books and other documents.

This paper was prepared for the Federal Environmental Assessment Review Office (FEARO). FEARO is developing and implementing more systematic and effective approaches for the scoping of EIAs within the federal Environmental Assessment and Review Process (EARP).

This paper focuses on scoping in the early stages of EIA. "Early" is purposefully vague here, but would include scoping undertaken before major environmental analyses are commenced at the screening, initial environmental evaluation or public review stages of an EIA.

1.2 THE LITERATURE

In order to structure this study, an early attempt was made to locate documents providing a comprehensive overview of scoping methods. However, no recent overviews were found. Instead, references to scoping in the literature tend to be scattered in case studies on the use of specific methods or in general articles on EIA. This review therefore confirms that the methods being used to scope EIAs are not well documented in the literature.

Despite the scarce and scattered documentation, there are some reports on methods used by various agencies and consultants in scoping EIAs. This literature casts doubt on whether any single method can accomplish scoping. The experience documented in the literature suggests that scoping is not a method, but a set of methods which are assembled in various combinations and sequences to accomplish the objective of "scoping" an assessment. (see Shopley and Fuggle, 1984)

This review further found that methods used for scoping are not unique to the scoping phase of EIA, but are general EIA methods, such as checklists and matrices. The difference is that these methods are applied to accomplish the objective of "scoping" rather than the full assessment. In addition, there are methods which are not traditional EIA methods but which are useful for scoping, such as public involvement processes and group process methods.

In summary, there are no recent published overviews of the literature on scoping methods, and references to scoping are scattered. At the same time, several methods can be identified which appear to be useful for scoping, including both traditional EIA methods and other techniques. It is therefore necessary to review a wide range of methods and to evaluate which of these methods could be usefully applied to scoping EIAs.

1.3 CANADIAN CONTENT

The goal of this paper was to review published literature from Canada, the United States and elsewhere on the subject of scoping. Because scoping has been a high profile and formalized procedure in the United States, many of the references in this paper are American. Many of the scoping efforts carried out in Canada, unfortunately, have not been documented in published case histories. This is regrettable. The more flexible and less formalized EIA context in Canada has led to some interesting scoping experiences, but these have not been well documented. Indeed, Canadians have been leaders in the development of EIA methods; many of the sources used in this paper are Canadian, e.g. Holling, 1978; Munn, 1979; Beanlands and Duinker, 1983; Whitney and Maclaren, 1985.

Documentation of Canadian scoping experiences would be a valuable step in developing improved methods for scoping. Therefore, it is recommended that FEARO prepare a detailed description of the scoping processes used within each Public Review it conducts, and arrange for case studies of scoping conducted by initiating agencies on a random sample basis.

This documentation should provide a general description of the project and the context of the EIA. It should describe the nature of the concerns raised by scientists, government agencies and the public. It should describe how these concerns were identified, evaluated, organized and communicated to the proponent. It should also include a post-audit assessment of how effective scoping was and what benefits were achieved. The above analyses should enable scoping practice to develop on a documented trial-and-error basis.

1.4 HISTORY

Because environmental scoping is a process of deciding which issues should be part of a review, scoping has always been a part of EIA. (Ross, 1986) However, in the early years of EIA, little attention was given to scoping as a separate activity within EIA. Instead, scoping was carried out, if at all, in a cursory and ad hoc manner. This resulted in a serious lack of focus in most environmental impact statements. This lack of focus made EIA processes slower, less efficient, and less effective than they would have been otherwise. (Section 2.0)

In response to this lack of focus, the U.S. Council on Environmental Quality (CEQ) issued regulations in 1978 establishing "scoping" as a formal requirement in EIAs. The CEQ defined scoping as an early and open process for deciding which issues should be considered in an EIA. Since then, a variety of techniques have been used to "scope" environmental assessments. Most of these techniques are not new, but are existing EIA, public participation and group process methods. Sachs and Clark (1980) surveyed methods which were being used in the first year of scoping experience in the United States. They found that

> "the 'average' scoping process consists of preliminary scoping by the lead agency followed by one or two open meetings where attendees are informed of project details and then allowed to comment. The lead agency typically uses the transcripts of the meetings and its own analysis to formulate the EIS's scope."

Despite several years experience, the documentation of scoping practice in the United States is still sketchy. No recent comprehensive overviews could be located, although a few

reviews of individual agency practices have been published in government reports, research journals and anthologies.

In Canada, scoping has been introduced gradually. Efforts have been made in a number of EIAs to identify important issues. However, during this study, only occasional references were found in the published literature to the practice of scoping in Canada. Beanlands and Duinker (1983: 29), in their review of 21 Canadian EISs, found that although some EISs show evidence that scoping had been done, the methods used for scoping were not documented. It is therefore difficult to describe current scoping practice in Canada from an analysis of the published literature. It is possible, however, to describe in a general way how scoping practice is evolving in Canada.

In most jurisdictions, projects are screened to determine whether an EIS is required. Little documentation is available on scoping methods used at this stage. Where projects are referred for more detailed review, scoping is usually carried out as a government activity after it has been determined that an EIS is necessary for a project. The usual practice is for the government agency responsible for the environment, in consultation with the proponent, to prepare guidelines for an EIA. This usually involves consultation with government resource management agencies. (Couch, 1986: 5, 11, 13, 19, 23, 28, 31, 37, 39, 41, 43; Ross, 1986) It may (or may not) also include consultation with the public. (Couch, 1986: 10, 21, 23, 28, 31, 39, 43) More rarely, proponents may be allowed to develop draft EIS guidelines for consideration of government. (Couch, 1986: 37, 43)

The federal procedure for EIA in Canada is EARP. The first step in EARP is the screening of projects to determine whether further environmental analysis is necessary. Screening is conducted by the initiating agency - the government agency responsible for deciding whether to approve the project being reviewed. There is little published information on how scoping takes place during this screening phase. However, a 1984 canvass of practitioners in initiating agencies found that an ad hoc committee approach was generally used for screening projects. Projects were screened by a project planner or group, often with a site visit and without any direct use of EIA methods. In some cases, a two-level matrix was used (see Section 3.3). (Duffy, 1986: 4, 15)

In some cases, the initiating agency is unable to adequately assess the effects of a project or the effectiveness of mitigative measures during the project screening stage. In such cases, the project can be considered further through either an Initial Environmental Evaluation or a Public Review. An Initial Environmental Evaluation usually involves further study of the project proposal by the initiating agency. One of the goals of this stage is scoping -- to identify and evaluate the significance of potential environmental effects. In this stage, initiating agencies have used a variety of approaches. In some cases, they have conducted additional field research and surveys, or reviewed alternative designs. The advice of other departments has usually been sought. A public scoping meeting has often been held to identify issues. A variety of EIA methods have been employed including matrices, map overlays, and project team work on impacts and mitigation combinations. The results have usually documented in a report. (Duffy, 1986: 4, 15)

If a project is referred for a formal public review under EARP, the Minister of the Environment appoints a panel and provides it with a terms of reference. The terms of reference outline the general scope of the review, but allow the panel considerable latitude to prepare guidelines specific to the proposal being considered. The panel's guidelines describe what is to be included in the EIS and therefore define the scope of the EIA. To ensure broad input, panels have held open houses and public meetings to obtain public input on what an EIS should include. Guidelines have also been released in draft form to obtain the comments of technical agencies and the public. Panels have then used this input to "scope" or limit the information they will request in EISs to subjects of genuine relevance or

importance. (Couch, 1985: 10; Duffy, 1986; Ross, 1986) The specific procedures used to obtain public comment are described in later sections of this report.

While there is some flexibility in choosing which issues should be assessed in an EIA in Canada (federally and provincially), there is also some standardization. In some cases, the issues to be considered in an EIA are included in standard guidelines for certain project types, e.g. pipeline rights of way, mining developments. (Couch, 1986: 11, 21) In addition, there is some similarity in the required content of EISs in various jurisdictions. EISs usually include a description of the project, a description of the environment, an analysis of environmental impacts, a description of mitigating measures, and a statement of residual effects. (Couch, 1985: 5)

In a recent review of scoping practice within EARP, Ross (1986) found that while difficulties have been experienced, scoping practice has improved over time. In early EARP reviews, panels identified issues internally with minimal public consultation. Because new concerns frequently arose in public meetings, public consultation was introduced in the guidelines preparation process (i.e. scoping). This resulted in more issues being raised earlier in the review, however, few issues were dropped as insignificant.

The practice of scoping will continue to evolve in Canada. It is now increasingly recognized that scoping is necessary and beneficial. In addition, FEARO is committed to finding better ways to scope environmental impact assessments. (Duffy, 1986; Marshall et al., 1986)

2. AN OVERVIEW OF ENVIRONMENTAL SCOPING

2.1 WHAT PROBLEMS DOES SCOPING ADDRESS?

Environmental impact assessment (EIA) has become an accepted part of the process of evaluating project proposals. In this literature review, the focus is on the scoping phase of the EIA process. However, before scoping is defined, it is useful to identify some of the problems that scoping is meant to address. The literature identifies the following problems:

1. Environmental impact statements (EIS) have frequently been voluminous, thick, detailed and exhaustive documents with unnecessarily comprehensive data. At the same time, EIA procedures have often been cumbersome, inefficient and costly. (Bardach and Pugliaresi, 1977; Otto, 1977; Armour, 1979; Bisset, 1980; Sachs and Clark, 1980: 2; Beanlands and Duinker, 1983: 21; Richardson, 1983; Pease and Smardon, 1984; Marshall and Wolfe, 1986; Marshall et al., 1986).

2. Often, significant or "key" issues have not been identified and singled out for special attention. The practice has been to look at all issues and concerns which might be raised about a project, at least superficially, regardless of how significant the issues are to the public or decision- makers. (Armour, 1979; Beanlands and Duinker, 1983: 28-29; Ross, 1986)

3. Conversely, irrelevant and insignificant issues have frequently not been eliminated from consideration. Where issues have been eliminated, this has often not occurred until at least part way through the process. (Beanlands and Duinker, 1983: 28-29; Ross, 1986)

4. In some cases, the major issue or issues in an assessment have been missed altogether or not identified until late in the review. Too frequently, this has meant delays while EISs have been rewritten or supplementary information submitted. (Bardach and Pugliaresi, 1977; Sachs and Clark, 1980: 3; Petrich, 1984; Marshall and Wolfe, 1986; Ross, 1986)

5. In too many cases, EISs have been organized around scientific disciplines or standard chapter titles, using a catalogue or inventory style to describe impacts and provide related environmental information. This format does not highlight key issues for the reader; key issues are simply discussed as part of the subject heading. For example, the issue of hurricanes would be discussed under weather and climatic conditions. The impact of hurricanes on the project would be discussed under the project description. Because the EIS does not relate the information to central issues, the EIS becomes focused on the information itself rather than on the analysis of key impacts. The catalogue format thus does not assist the public and decision-makers in their analysis of key decision areas. (Bardach and Pugliaresi, 1977; Armour, 1979; Truett, 1979; Wolfe, 1982b; Beanlands and Duinker, 1983:28-29; Valiela, 1984; Beanlands, 1986; Marshall and Wolfe, 1986; Marshall et al., 1986)

6. In many cases, examination of issues and choice of alternatives has been completed outside of public view and without input from other government agencies. In some cases, input has not been sought even from the internal staff of the initiating agency itself - the government agency responsible for deciding whether to approve the project being reviewed. (Sachs and Clark, 1980: 3; Yost, 1981; Smith-Sanclare, 1984)

7. There has been a serious lack of attention to the temporal and spatial boundaries of most EIAs. The ecological rationale for defining these boundaries has been poorly documented. (Beanlands and Duinker, 1983: 28-29)

Several reasons were identified in the literature as to why the above problems have developed. It is useful to review these causes, since an understanding of causes will contribute to more durable solutions. The causes identified in the literature include the following:

1. Many review agencies, scientists and citizens hold firm beliefs that for an EIS to be adequate it has be a comprehensive, technical document providing full information. (Otto, 1977; Marshall and Wolfe, 1986)

2. Sometimes the collection of information becomes an end in itself, rather than serving the end of analysis for decision-making. When the collection of data dominates the assessment process, too little time is left for analysis and development of recommendations. (Roberts, 1984; Valiela, 1984)

3. Often it is easier to describe and analyze every possible issue than to prepare a well-written, concise analysis of the key issues. (Otto, 1977).

4. In some cases, governments have established guidelines or checklists specifying issues which must be considered in all EIAs for projects within their jurisdiction. EIS authors have then used these topics as chapter titles and simply filled in a respectable number of pages to cover each subject. (Bardach and Pugliaresi, 1977) Sometimes the guidelines prepared by a panel for specific projects have been too broad. (Wolfe, 1982b)

5. Many agencies, public groups, and scientists have a strong interest in certain subjects, whether or not these subjects are important in a particular review, i.e. they "specialize" in certain issues. Agencies tend to specialize in issues relevant to their mandate or policies. Scientists tend to specialize in terms of the intellectual grooves of their discipline. Public groups, formed to address certain issues (e.g. wildlife, employment), tend to focus their attention on these issues. Because of specialization, people may be reluctant to dismiss their issues as irrelevant. (Bardach and Pugliaresi, 1977; Sachs and Clark, 1980: 10, 58)

6. Some agencies or other participants may be afraid to commit themselves to a defined list of issues because this would compromise their autonomy and reduce their influence later in the review. In some cases, this reluctance may result from a lack of trust in the lead agency. (Sachs and Clark, 1980: 10)

7. Peripheral issues may be injected by the opposition to attack the proponent's proposal (Myatt, 1984).

8. Peripheral issues may be also be raised in remote areas because there is no alternative forum where local issues can be addressed.

9. Consultants and others may have a financial incentive to inflate the breadth of the study. (Myatt, 1984)

2.2 HOW IS SCOPING DEFINED?

The term "scoping" refers to a set of processes and methods used to address the problems identified above. Although not implemented very well in earlier assessment programs, scoping is a generic part of any decision making process. Scoping is a process for defining what the issue are and how they will be studied.

There is no consensus on how scoping should be defined. Since this is a literature review, attributes of scoping which have been suggested in the literature are presented below. However, it should be noted that while many of these suggested attributes apply to EIA, there may be debate as to which apply to scoping. The attributes suggested in the literature are as follows:

1. Scoping should take place early in the assessment process, before research is commenced on the EIS. (CEQ Regulations, 1978; Sachs and Clark, 1980: 3; Haug et al., 1984b; B.L.M., 1984; Pease and Smardon, 1984; Marshall et al., 1986) Determinations made in scoping can be revised later if substantial changes are made in the proposed action or new circumstances or information arise. (Wolf, 1983; Ross, 1986; CEQ Regulations, 1978) Some argue, based on the above, that scoping is a continuous process throughout environmental analysis. (Haug et al., 1984b)

2. Scoping should be conducted in an open manner, with full and ample opportunities for participation by the proponent, affected interests, relevant government agencies and the general public. Accomplishing this means, among other things, identifying and notifying of everyone who might be affected by a project. (CEQ Regulations, 1978; Sachs and Clark, 1980: 3; Wolf, 1983; Haug et al., 1984b; Marshall et al., 1986)

3. Scoping should determine the range of project alternatives to be considered in an EIA, including mitigative measures. This includes actions which are closely related, interdependent, or cumulative in nature. (CEQ Regulations, 1978; Haug et al., 1984b; Pease and Smardon, 1984; B.L.M., 1984)

4. Scoping should identify the public and agency concerns about a project action or proposal. (Beanlands and Duinker, 1983: 5, 18, 71; Yost, CEQ, 1981; Haug et al., 1984b; Ahmad and Sammy, 1985)

5. Scoping should evaluate which public and agency concerns are important enough to be examined in detail in an EIA (CEQ Regulations, 1978; Sachs and Clark, 1980: 3; Yost, CEQ, 1981; Beanlands and Duinker, 1983; Haug et al., 1984b; Pease and Smardon, 1984; Ahmad and Sammy, 1985; Duffy, 1986: 16; Beanlands, 1986; Marshall et al., 1986)

6. Scoping should eliminate from detailed study public or agency concerns which are not significant for a particular EIA (CEQ Regulations, 1978; Yost, CEQ, 1981 B.L.M., 1984; Ahmad and Sammy, 1985; Marshall et al., 1986)

7. Scoping should develop appropriately-framed study designs to guide research necessary to provide information for decision-makers to make decisions concerning a project under review. This might include identifying who should address certain issues (whether proponent or government resource agencies). (Beanlands and Duinker, 1983: 5, 18, 71; CEQ Regulations, 1978; Yost, CEQ, 1981; Wolf, 1983)

8. Scoping should define the impact area boundaries and time horizons of importance in the EIA (Beanlands and Duinker, 1983: 93: Wolf, 1983; Roper, 1986)

9. Scoping should determine the level of detail required in an assessment (Wolf, 1983), possibly specifying the page limits for the EIS or time limits for the EIA procedure. (CEQ Regulations, 1978; Yost, CEQ, 1981)

10. In the United States, there is a requirement that the scoping process should identify other EIAs which are related to the present EIA but not part of it. (CEQ Regulations, 1978; Yost, CEQ, 1981) This requirement helps to avoid redundant reviews and assists in the consideration of cumulative effects of related projects.

11. The U.S. scoping process also requires identification of environmental review and consultation requirements related to the project approval decision so that agencies and others can prepare required analyses and studies concurrently with the present EIA. Agencies are required to tentatively identify their decision-making schedule concerning the project under review. (CEQ Regulations, 1978; Yost, CEQ, 1981; Pease and Smardon, 1984) This requirement is not part of the Canadian EIA procedures. However, the clarification of the decision context is an important requirement of any public review process. (Wolfe, 1974)

It is arguable that the attributes identified above should be a part of the early stages of an EIA process. However, what is the essence of scoping? To structure this review, a working definition of scoping was adopted in this paper. This definition is discussed more fully in Section 3.0. This concept trims the definition of scoping down to three essential functions:

i. Identification of concerns of the public and scientists about a proposed project or action.

   (Function (i) is item 4 in the above list of attributes, but includes items 1, 2 and 3.)

ii. Evaluation of these concerns to determine the key issues for purposes of the EIA (and the elimination of issues which are not significant).

   (Function (ii) encompasses items 5 and 6 in the above list.)

iii. Organization and communication (focusing) of these issues to assist in the analysis of issues and the ultimate making of decisions.

   (Function (iii) encompasses items 7, 8, 9 and possibly 10 and 11 in the list above.)

These are considered the essential functions of scoping. However, the references in the brackets show that these functions include (directly or indirectly) many of the attributes of scoping identified in the literature. This definition is developed further in Section 3.0.

2.3 WHAT ARE THE BENEFITS OF SCOPING?

Several benefits have been identified in the literature for a successful scoping process:

1. The EIA process provides environmental information to assist public officials and citizens for making decisions concerning projects. The intent of scoping is to ensure that this information is more useful and understandable to decision makers and the public. It improves the quality of that information by focusing scientific efforts and EIA documents on the truly significant issues. It helps to ensure that the real problems are identified early and studied properly. (CEQ Regulations, 1978; CEQ, Yost, 1981; Marshall and Wolfe, 1986; Marshall et al., 1986)

2. By identifying potential project alternatives and mitigation measures early in the EIA process, the scoping process helps to shape the planning of the project. This allows environmental considerations to be incorporated into plans at the same time as project design and cost factors are considered. (Duffy, 1986: 16) In some cases, this may result in issues being resolved at the scoping stage. (Ross, 1986)

3. By increasing the focus of EIA documents, scoping reduces the size of the EIS and thereby reduces paperwork. (CEQ Regulations, 1978; Duffy, 1986; Marshall and Wolfe, 1986; Marshall et al., 1986)

4. Scoping ensures that research efforts are not wasted on insignificant issues. It gives direction to the effort and allows for focused and cost-effective reviews. It cuts a manageable piece from the whole, retaining the minimum complexity necessary for a valid, credible and useful assessment. (CEQ, Yost, 1981; Duffy, 1986; Roper, 1986; Marshall and Wolfe, 1986; Marshall et al., 1986)

5. Scoping reduces the likelihood of overlooking important issues. (Duffy, 1986; Ross, 1986) This reduces the possibility of delays which would result from redoing inadequate EIS drafts. (Sachs and Clark, 1980: 78; CEQ, Yost, 1981)

6. Scoping diminishes the chance of protracted conflicts and delays in project reviews by engaging all parties in a constructive participatory process. It encourages participants to raise issues as early as possible in the process. If participants hold back and do not bring up their concerns, they may have a hard time prevailing at a later stage if they raise new issues. (Sachs and Clark, 1980: 3, 71-77, 78; CEQ, Yost, 1981; Duffy, 1986; Marshall et al., 1986) In the United States, scoping may also reduce the likelihood of conflicts leading to litigation over the adequacy of an EIS. (Sachs and Clark, 1980: 71-77; CEQ, Yost, 1981)

7. Scoping can be helpful in structuring the work of conducting the EIA and writing the EIS. For example, it can assist in achieving early agreement among all parties to the review on what needs to be studied. (Duffy, 1986) This means that those preparing submissions (e.g. proponent, public) are all addressing the same set of issues, and using their resources more efficiently and effectively.

Sachs and Clark (1980 78-79) found that many of these benefits have not been realized from early scoping efforts, despite the use of innovative procedures in many cases. In trying to sense why this is the case, they conclude that the following ingredients are important to success:

1. Commitment. Agencies should be committed to the processes of scoping and EIA, and be willing to use the results of these processes in their decision-making. Many agencies have not understood the purposes and benefits of scoping. "Commitment is one precondition that guidance and regulation cannot strengthen".

2. Participation. Participation is the public's side of the commitment question. Opportunities must be provided for all stakeholders to participate in the process.

3. Communication. Many scoping efforts have involved one-way flows of information and ideas. Agencies distribute information and the public comments. The most effective innovative processes have involved two-way processes for communication with opportunities for consensus building.

4. Information. The effectiveness of scoping processes have been directly related to the timing and level of information provided to participants about the proposed project, the regulatory requirements, and possible effects. (see also Marshall and Wolfe, 1986: 115-116)

5. Flexibility. The best scoping procedures have been designed for a particular review situation. Consideration was given to the nature of the project, the applicant, and the participants, as well as costs, geography and other factors. No one method has been effective in all circumstances.

3. AN APPROACH TO SCOPING

This section discusses the three functions of scoping (identification, evaluation, and organization/communication) introduced in Section 2.2. These three functions form the basis for the balance of this report.

3.1 SCOPING FUNCTIONS

In Section 2.2, a definition of scoping was adopted for this report consisting of three functions. These functions are:

i. Identification of concerns of the public and scientists.

ii. Evaluation of these concerns to determine the key issues (and to eliminate issues which are not significant).

iii. Organization and communication (focusing) of these issues to assist in the analysis of issues and the ultimate making of decisions.

With the first function, variety increases as a wide range of concerns, issues and questions are identified. With the second function, variety decreases as concerns are evaluated, and significant issues determined and insignificant issues weeded out. With the third function, the remaining issues are organized into categories that are meaningful to the public and to decision-makers, and defined in terms that assist in carrying out assessment studies. It is important to distinguish these functions because there appears to be a consensus in research findings that these functions are very distinct decision-making activities and require different roles and methods. (Osborn, 1953; Delbecq et al., 1975: 9; Lang, 1981: 91-92; McAllister, 1980)

The three functions of scoping are usually carried out partly iteratively and partly at the same time. However, they may be thought of "phases" since concerns must be identified before they are evaluated, organized and communicated.

3.1.1 Increasing Variety - The Broad Identification of Concerns

The first function of scoping is to identify the broadest possible range of issues and concerns which could be addressed in an EIA. During the identification stage, the assessor seeks to identify all concerns which might exist concerning a project. The project is analyzed to identify project actions and the primary and secondary effects of these actions. Scientists, government agencies and the public are asked to identify their concerns. As the identification of concerns proceeds, the level of detail increases as more and more concerns are identified. No attempt is made as yet to evaluate which concerns are significant. This stage is necessary to gain a detailed listing or "long list" of the many potential consequences of a project.

The identification function requires methods encouraging creative thinking and insight. Judgment and evaluation are deferred, allowing ideas to flow freely. The goal is to be comprehensive. No attempt is made to eliminate concerns. Many methods are available for identifying concerns in the EIA process and elsewhere. This is an area where EIA methods appear particularly strong. (Osborn, 1953; Warner and Preston, 1974; Munn, 1979; Jain, et al. 1977; Clark, et al., 1978a; Fuggle, 1979; Lang, 1981: 91-92: Shopley and Fuggle, 1984)

3.1.2 Decreasing Variety - The Evaluation of Issues

The identification function produces a 'long list' of unevaluated concerns, worries, issues and problems which have been raised by citizens, scientists, government agencies and others. The goal of the first step is to increase variety – to identify as many concerns as possible.

The second function of scoping is the 'processing' of these concerns to highlight significant issues for further assessment. This involves using various methods for evaluating concerns that have been identified. The goal is to decrease variety – to eliminate concerns that are not relevant or significant. The long list of issues is evaluated and chopped down to eliminate trivial, irrelevant or inappropriate issues and to derive a "short list" of key issues.

The evaluation function requires a different type of thinking, and therefore different methods, than the identification function. The assessor must be critical and judgmental in looking at the list of concerns. Methods must be suitable for evaluating and screening issues for their relevance and importance. Evaluation requires placing values on concerns - a function that is obviously subjective. While methods for identifying issues are common, fewer methods are available or useful in evaluation (measurement, interpretation). (Warner and Preston, 1974; Munn, 1979; Jain, et al. 1977; Clark, et al., 1978a; Fuggle, 1979; Lang, 1981: 91-92: Shopley and Fuggle, 1984) As a result, the assessor is often required to depend on his own judgment. (Lang, 1981: 91-92)

Section 3.2 discusses the role of subjective or value-based judgments in the evaluation of issues. That section provides a context for understanding methods used for evaluating issues and for making responsible value judgments in the evaluation phase.

3.1.3 Focusing - The Organization and Communication of Issues

The third function or phase of scoping is to organize the issues in order to provide a coherent, integrated view of the issues. The first phase identified a long list of unevaluated concerns. These concerns were processed in the second phase to produce a list of important issues. However, at the end of the second phase, this list is not organized, but left in a random order. The focusing stage attempts to impose an order on these issues. The issues are sorted into categories that provide an integrated and coherent view of the overall impact of a project. The issues are also carefully stated (formatted, defined, clustered) to allow them to be studied in a scientifically appropriate manner.

Where the first two functions require creative and judgmental methods respectively, the third function requires methods which integrate and synthesize. The assessor identifies relationships among the issues. For example, one of the effects of an oil spill could be a fish kill, reducing the fish stocks available for commercial harvest. The issue of dead fish and reduced harvest are really the same issue, and should be considered together. At the same time, the issues of lost income to fishermen, decline of community economic bases, and disruption of family harmony could all be clustered in the same issue category. In looking at this category, the fishermen can obtain a better grasp of the overall implications of an oil spill on their lives. The purpose of focusing is thus to achieve this kind of overview.

3.1.4 Scoping Functions in this Report

The three functions of scoping described above form the basis of the rest of this report. The first two functions, identification and evaluation, are often carried out using the same methods. For example, matrices are used as a memory aid (mnemonic) for identifying issues, but can be designed to evaluate the same issues. Three types of method are useful for

the identification and evaluation functions: EIA methods, public participation methods, and group process methods. These are discussed in Sections 4.0, 5.0 and 6.0 respectively.

The focusing function of scoping is different. While many of the above noted methods can contribute to focusing, the focusing function is sufficiently unique that it is discussed separately in Section 7.0. Where appropriate, the focusing aspects of methods discussed in Sections 4.0, 5.0 and 6.0 are discussed in those sections. Section 7.0 highlights a few methods that are particularly appropriate for focusing issues.

3.2 EVALUATION

The essential intellectual process involved in the second function of scoping is evaluation: evaluation of which issues are significant (or insignificant). This section reviews comments in the literature on the evaluation of issues and sets a context for discussing scoping methods used for the evaluation. It first discusses the role of value judgments in evaluation. It then discusses the use of scoping criteria in making responsible value judgments.

3.2.1 Value Judgments

Every method used in environmental impact assessment and scoping requires the use of value judgments. Value judgments are a fundamental part of any assessment or scoping method. In the identification function, there is a bias toward identifying or "seeing" issues which appear relevant because of our own values and perspectives. In the focusing phase, there is a bias toward organizing issues into frameworks or categories that make sense to ourselves. However, in deciding what is or is not an issue worthy of consideration, value judgments are the essence of the work. This section therefore focuses on the role of value judgments in evaluative decisions. (Matthews, 1975; Ghiselin, 1982; Pease and Smardon, 1984)

In his analysis of EIA processes, Matthews (1975) shows that "...the analysis of environmental impacts requires both objective and subjective judgements at almost every stage..." Matthews defines objective judgments as

> "those [judgments] which involve or use facts that are observable or verifiable - especially by scientific methods - and which do not depend on personal reflections, feelings or prejudices..."

Subjective judgments, on the other hand, are

> "those [judgments] which are made on the basis of values, feelings, and beliefs. They generally vary widely from person to person, group to group, institution to institution, and society to society."

Many attempts have been made to devise methods which are intrinsically objective and scientific, on the assumption that it would be possible to eliminate value judgments and subjective opinion from the analysis. An example is found in EIA methods where value weightings have been built into EIA methods to indicate the significance or importance of a resource or impact. In some cases, there has been an attempt to convert impacts into identical units so they can be added into a single score. McAllister (1980) refers to these approaches as "grand index methods".

Bisset (1980) argues in his review of EIA methods that "the dominant trend has been toward an inflexible reductionist and mechanistic approach [to impact assessment]. Rigid logico-mathematical frameworks, often derived from other fields, have been manipulated for impact analyses...." He argues that because these EIA methods must be used in political processes, they will be of limited relevance in the future. He argues that

> "U.S. experience would seem to indicate that quantitative methods will play a decreasing role in impact analyses.... It is likely that the role of impact analysis in political debate surrounding contentious proposals will result in the use of methods which eschew quantitative manipulations and concentrate on the provision of qualitative, descriptive information on impacts." (see also Rosenburg and Resh, 1981)

Although the evolution of Canadian EIA methods is not well documented, a review of recent EISs suggests that few predominantly quantitative methods appear to be favoured in EIA.

The evaluation of the significance of concerns thus involves value judgments and subjective decisions. The assessor cannot avoid this responsibility. However, this responsibility can be structured in a way that is more explicit, accountable, rigorous, consistent, systematic and objective. (Matthews, 1975; Ames, 1978; Haug et al. 1984b) The question is how do we do handle questions of subjective evaluation responsibly? Two answers have been prescribed by various writers:

(1) Where value judgments are required, the public must be involved in deciding what values should be applied. (see Beanlands, 1986; McAllister, 1980: 264)

(2) Where value judgments are made, they should be clearly identified and made explicit for the scrutiny of decision makers and the public. (Otto, 1977; Lee, 1982; Ghiselin, 1982)

One approach which can be used to accomplish both prescriptions is the use of explicit scoping criteria. (Ames, 1978)

3.2.2 Scoping Criteria

Scoping criteria are explicit statements of the values which should be used to evaluate whether an issue is important or not. Scoping criteria can be explained with the example of an oil spill. Suppose one of the effects of an oil spill is a fish kill. How do we determine if the fish kill is significant?

Government often establishes criteria for deciding when an effect is acceptable in terms of regulatory "standards". Such standards, if they reflect society's values, could be one criterion for judging issue significance. In another case, if the fish species is rare and could become extinct, society is likely to consider the effect significant. On the other hand, if the fish species is a commercially harvested species upon which many people depend for a livelihood, the effect would be deemed important by fishermen and consumers. In another case, if the fish is prey to an important species of marine mammal, it may be deemed significant to environmentalists and the general public. In each case, a value judgment was made, and someone had to decide how large the fish kill had to be before the effect was judged significant. This example highlights the social nature of the values that are weighed in making the evaluative decision on the importance of an issue.

The essential issue is that, no matter what the situation, when an impact or issue is considered either significant or not significant someone made a value judgment. As discussed in Section 3.2.1, when value judgments are made, the public should be involved in deciding what values should be important. Further, as far as reasonable, the assessor should be explicit in stating what values were used in making the judgment. Scoping criteria can and should be developed in consultation with the public and with affected interests. They should be explicitly stated. If these conditions are met, the quality of value judgments can be considerably improved.

It is beyond the scope of this paper to review in depth the scoping criteria that might be applied in making evaluative decisions. Further, as noted previously, these criteria should be determined in consultation with the public. Choosing the appropriate criteria is the responsibility of the agencies undertaking the EIA. However, some of the criteria proposed in the literature are outlined Appendix A. In addition, a review of criteria is provided in Rau and Wooten (1980).

4. EIA METHODS

This section analyzes how traditional EIA methods address the three functions of scoping: identification, evaluation and focusing. Shopley and Fuggle (1984) and others classify EIA methods as follows: ad hoc approaches, checklists, matrices, networks, overlays, evaluation techniques, environmental modelling, and adaptive methods. Ad hoc approaches are not discussed here.

4.1 EXAMINATION OF SIMILAR PROJECTS

The examination of similar projects is not included in typical lists of EIA methods (see above). Beanlands and Duinker (1983: 84) argue that "it is somewhat surprising, as well as discouraging, to see the limited use made of this approach in impact assessment studies...." Andrews et al. (1977) lament that

> "so little appears to be learned from one impact statement to another to the next. Rarely does one impact assessment provide a baseline for later ones, either by the same or different agencies. Each appears to be conducted as a discrete, ad hoc exercise without cumulative learning."

There are several methods for examining similar projects to identify possible project effects. First, the assessor can review environmental impact statements and the reports of EIA panels concerning similar projects or projects in similar geographic or environmental settings to determine what issues were identified. The assessor can also contact EIS teams involved in preparing these EISs. (Baker et al., 1977: 93-96)

Second, a number of post-audit studies of past EARP reviews have been done, e.g. Shakwak Highway Project, Norman Wells Oilfield development and pipeline project, and the Eastern Arctic - South Davis Strait Drilling project. (Rigby, 1985) Post-audit studies examine the accuracy of EIA predictions and how well proponents complied with EIA recommendations and other regulations. As the number of post-audit studies increases, substantial information will be available to assist assessors in identifying the issues most important in a certain type of EIA.

Beanlands and Duinker (1983) argue that the accuracy of EIA predictions must be monitored to obtain valid and useful information for assessing future projects. This means each project should be designed as an experiment with testable hypotheses for future monitoring. Without testable hypotheses, it is difficult to accurately assess whether the predictions made in an EIS were reasonable. With hypotheses, scientists can learn what effects might actually occur with different types of project and more quickly focus future assessments on key issues. (Richardson, 1983)

Third, there are a variety of generic reviews of impacts and issues associated with specific project types, e.g., highways, airports, railways and rail transit systems, sewerage and solid waste, water resources, energy development, transmission and use, and new towns and subdivisions. (see Armour, 1979: 83-121 and Falk and Muller, 1983, for bibliographies; Ahmad and Sammy, 1985; Johnston, 1981; Leistritz and Murdock, 1981; Hitchcock, 1977). In addition, assessors often undertake special literature reviews to determine what potential project effects have been reported in the literature.

Comments

Examination of similar projects is an important method for identifying potential impacts. If a certain type of project has been reviewed before in an EIA, then at least some of the issues have been identified. The assessor should start with these issues, and determine what new issues might apply to the project being considered.

Examination of past projects can also assist in evaluating the importance of issues. Where careful monitoring and post-audit studies have been done, scientific information may be available to help the assessor to evaluate whether an effect will occur and how important this affect might be.

While examination of similar projects may assist in evaluating EIA issues, each project should be carefully considered on its merits. First, the predictions made in one area may not be transferable to other areas; there are often significant differences in environmental systems in various regions. Second, the assessor must be sure that the scoping criteria used in past assessments is relevant to the present assessment. For example, the citizens of one area may be more concerned about employment or rare fish than the citizens of another area. Since citizens should be involved in determining criteria, the same effects may not be evaluated the same in different regions.

Despite these concerns, examination of similar projects should be a first step in any scoping exercise. It provides insights into what has been learned elsewhere and provides a rapid overview of the issues.

4.2 CHECKLISTS

Munn (1979) describes checklists

> "as comprehensive lists of environmental effects and impact indicators designed to stimulate the analyst to think broadly about the possible consequences of contemplated actions".

They may also be lists of the types of information to check in preparing an EIS. (Lee and Koumjian, 1978: 51-52)

Checklists have been used by government agencies to ensure that a prescribed list of possible impacts is considered in each EIA under its jurisdiction. (Rau and Wooten, 1980) An advantage of checklists is that they "promote thinking about the array of impacts in a systematic way and allow concise summarization of effects". (Westman, 1985: 131-133) Checklists are thus primarily a method of identifying possible project effects.

One criticism of the use of checklists for identifying impacts is that impacts not on the list may be ignored (i.e. tunnel vision). Munn (1979: 31) suggests this criticism can be made of any method. Further, Rees (1976) suggests the continuing modification of checklists based on project experience helps to prevent tunnel vision of new projects.

Another criticism is that checklists are too general. (Westman, 1985: 131-133; Bradley, 1980) Because general, all-inclusive checklists addressing all types of projects in all environmental settings would be too large and cumbersome, government agencies have developed specialized checklists applicable to the types of projects and activities within their jurisdictions. (Rau and Wooten, 1980: 8-5; Lee and Koumjian, 1978: 50; Dickert, 1975)

There are also concerns about the human factor. The use of a checklist is subjective and qualitative; different assessors using the same checklist may reach different conclusions about what effects might occur. (Westman, 1985: 131-133) In addition, the use of checklists assumes assessors have the ability to determine whether effects would occur in specific situations; this was often not the case. There is also concern that the mechanical process of checking off impact categories on a checklist, by its very nature, tends to promote thoughtless answers. (Bradley, 1980)

Another criticism is that checklists do not consider the underlying environmental systems and direct cause-effect links to project activities. (Jain et al., 1977: 73; Rees, 1976: 54-59; Westman, 1985: 131-133) As a result, since there is no conceptual understanding of the processes leading to impacts, some impacts can be missed and others double-counted.

Despite their drawbacks, checklists are among the most common tools used to identify potential impacts. (Westman, 1985: 131-133; Munn, 1979: 30ff) Checklists are frequently used in Canadian EIAs to identify possible project effects. (Duffy, 1986: 15) They are also relatively easy to use. As a result, checklists are especially useful at a preliminary stage as a first step in a more sophisticated procedure. (Rees, 1976)

While checklists are primarily a method for identifying impacts, some checklists are useful in a limited way for the second function of scoping - the evaluation of issues.

Several checklist methods use weight-scaling procedures to evaluate the importance of the environmental components affected by a project. An example is the Battelle Columbus Laboratories' "environmental evaluation system" - a checklist-type procedure developed in the early 1970s to assess water resources projects. (Dee et al., 1973) The Battelle system is described here as an example of a whole class of checklist methods. The Battelle system measures the environmental impacts which project actions can have on a standard list of 78 environmental components. These measurements are converted to common impact units using scalars. A multi-disciplinary team of experts uses a Delphi method (see Section 6.3) to assign importance weights to the 78 environmental components. These are mathematically processed to aggregate the weightings into a single score for each project alternative. This allows project alternatives to be compared using a single number. (Westman, 1985: 149-152; Shopley and Fuggle, 1984; Munn, 1979: 48-53; Jain et al., 1977)

The Battelle method has several problems. Westman describes problems associated with the mathematical techniques used in the method. In addition, while the method looks scientific, it is based on the value judgments of the experts; the values of these experts may not necessarily reflect the opinions of the multiple publics who might be affected. (see Section 3.2) The method also involves some double counting since the same effect may be identified within several categories on the list; this is a problem when results are aggregated because the double counting increases the weighting of certain effects. At the same time, the Battelle checklist fails to evaluate second and higher-order interactions of the project and environment; thus some effects may not be included in the aggregation. (Westman, 1985: 151-152)

The Battelle system is one of the best known early checklist-type scaling techniques. Others are described in Westman (1985: 152-155), Shopley and Fuggle (1984: 30-31), Jain et al. (1977: 78-90), and Warner and Preston (1974). The common criticism is that the weighting systems require too many subjective judgments by experts, and the aggregation process obscures these judgments from scrutiny by the public and the decision-maker.

One checklist approach which may have merit for the evaluation function of scoping for simple projects is the programmed-text approach used by the U.S. Navy. (Bradley, 1980) It consists of a set of "filter questions" which ask, for example, whether the project is in an aquifer recharge area. If the answer is yes, further evaluation is needed. If the answer is

no, the issue is deemed unimportant. There are 47 filter questions in 7 categories: ecology, earth resources, air quality, ground water, surface water, socio-economics, and occupational health and safety. Bradley concludes that this approach has improved the quality of routine project assessments. Moreover, using this method, the depth and scope of the assessment can be designed to suit the nature and scale of the project.

Greenburg et al. (1979) describe a similar approach with two sets of questions used for assessing industrial development projects. The first list of 22 questions helps the user to decide if any cause for concern exists. For example, one question asks if any oxygen demanding wastes would be discharged. The second list of 38 follow-up questions helps users determine if their concern should be minor or major. For example, a follow-up question to the discharge of oxygen-demanding wastes would ask whether these wastes could be handled adequately by septic systems. No weights are assigned to the concerns, since while people might agree that a concern exists, they might disagree on what priority or weight to assign to it.

Comments

Checklists are useful for the identification function of scoping. Some criticisms of checklists assume that checklists are used in isolation from other methods. If checklists are used, other methods should be used to ensure all potential effects are identified, especially higher-level impacts.

Weight-scaling checklists are too sophisticated and subjective for the evaluation function of scoping. However, the use of programmed-text approaches with evaluative questions deserves further attention. These approaches highlight important issues yet do not rely on complex aggregations. The questions asked can be based on the scoping criteria the agency has developed for evaluating issues. The programmed-text approach would be especially useful for scoping relatively routine project proposals at the screening stage of EARP. At this stage, the answers to the questions could be recorded as part of the screening documentation of the initiating agency.

4.3 MATRICES

Impact identification matrices are two-dimensional checklists with project activities on one axis and potentially-affected environmental components on the other. An example is provided in Figure 4.1. Matrices are used to summarize and display interactions between project actions and environmental characteristics. (Shopley and Fuggle, 1984; Rau and Wooten, 1980; Lee and Koumjian, 1978: 52-54; Dickert, 1975)

Matrices have a number of advantages for the identification function of scoping. They are useful for identifying first order cause-effect relationships between specific activities and impacts. They also provide a useful visual aid for quickly cross-referencing sources and effects. (Shopley and Fuggle, 1984; Lee and Koumjian, 1978: 52-54; Jain et al., 1977; Rees, 1976) This may be helpful for the focusing function of scoping.

Matrices, however, suffer from many of the same drawbacks as checklists. Like a checklist, using a matrix requires many subjective judgments. A matrix can also be very detailed and cumbersome - even more so than a checklist. The Leopold Matrix, for example, has 100 project actions and 88 social and environmental components (8,800 cells). Using a large matrix can be time consuming and when completed, the mass of information is often difficult to conceptualize. (Westman, 1985: 133-142; Shopley and Fuggle, 1984; Lee and Koumjian, 1978: 52-54; Rees, 1976) However, a computer can reduce the size of the matrix

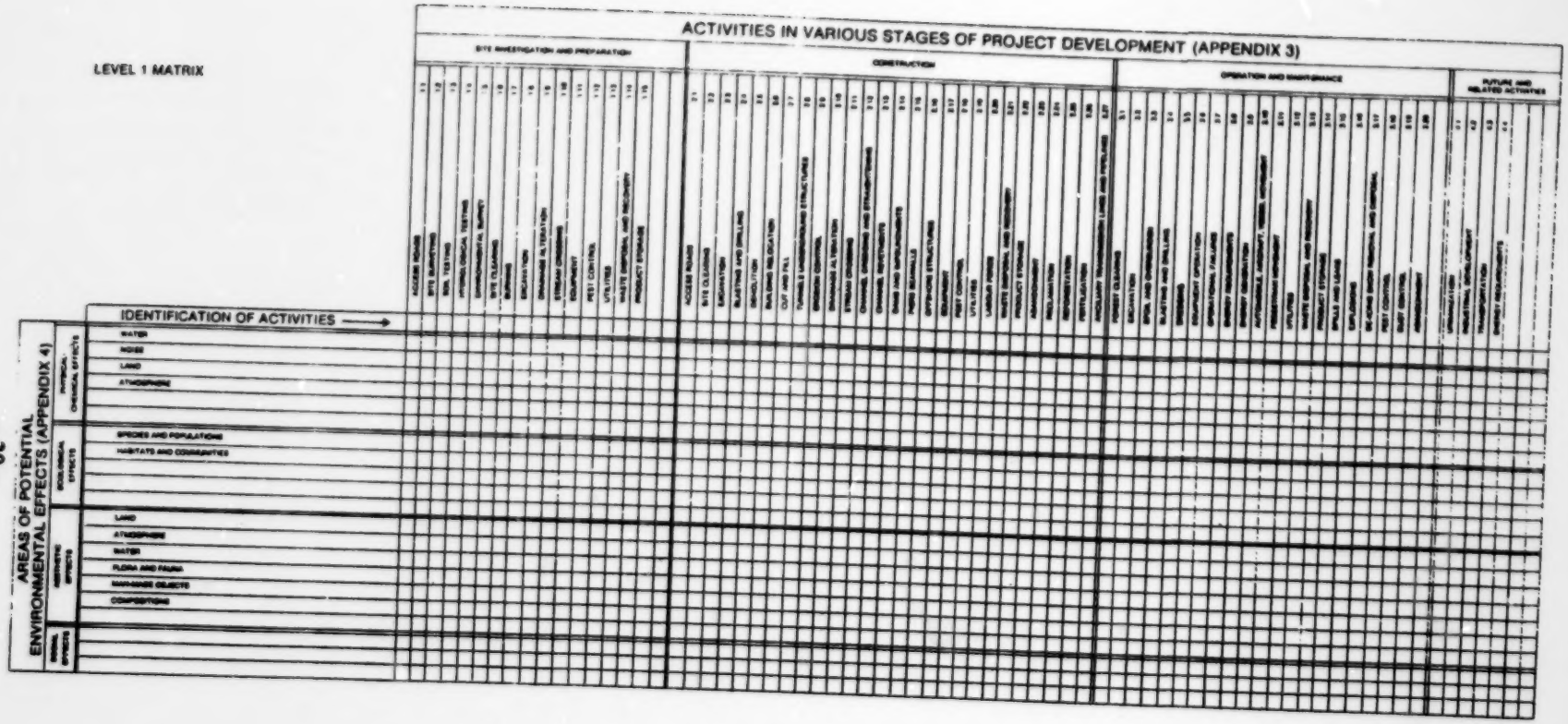

FIGURE 4.1: IMPACT IDENTIFICATION MATRIX.

This is an impact identification matrix taken from FEARO's Guide to Environmental Screening (1978). The above matrix is a Level 1 Matrix which is used for a broad level evaluation. The Guide also provides a Level 2 Matrix which focuses on more specific environmental impact areas. Appendices 3 and 4 of the Guide provide details of what should be considered in deciding whether a particular cell should be checked.

by presenting only those cells where impacts are identified. In addition, focusing matrices have been developed to reduce the detail found in standardized matrices. (Fisher and Davies, 1973; Ministry of Environment, 1985) These are discussed below.

Although matrices can be very detailed, they often fail to identify all important effects. (Rees, 1976) Matrices do not display the network of interrelationships in the environment. (Lee and Koumjian, 1978: 52-54) As a result, they are especially weak in the identification of higher-order effects, although three dimensional matrices have been devised to display these effects. Various modifications have been introduced to improve identification of second- and higher-order effects, for example, the Component Interaction Matrix (CIM) developed by Environment Canada. (Shopley and Fuggle, 1984)

Another criticism of matrices is that the items included on each axis determine what impacts and issues are identified. For example, the CIM omits socio-economic impacts. This means that significant value judgments may go into the design of a matrix.

Despite their drawbacks, matrices are among the most common tools presently used to identify potential impacts. (Westman, 1985: 131-133; Munn, 1979: 30ff) They are used in Canadian EIAs as a scoping method. (Duffy, 1986: 15) There are a variety of approaches for using matrices, and for many project types they can be an extremely useful method for impact identification.

While matrices are used primarily to identify and display project impacts, some matrices are useful in the evaluation phase of scoping. The best known matrix is the Leopold Matrix. The Leopold Matrix is a project action/environmental component matrix which uses a simple scoring procedure to identify the potential magnitude and significance of impacts. Scoring is based on the subjective judgment of the analyst. The value of the method is primarily in the identification of possible interactions, although it allows a simple form of evaluation. (Jain et al., 1977: 83-84; Holling, 1978: 74; Munn, 1979: 38-43; Shopley and Fuggle, 1984: 31)

A variety of mathematical matrices have been developed - cousins of the weight-scaled checklists discussed in Section 4.2. Because quantifying of impacts is often difficult, these matrices have not played an important role in EIA. (Shopley and Fuggle, 1984) An example is the Peterson matrix which uses one matrix to score impacts of project actions on the environment and another matrix to score effects that affected environmental components have on the human environment (secondary impacts). The matrices are multiplied and the product matrix multiplied by a vector of human weights. These are aggregated to produce a single overall score. (Shopley and Fuggle, 1984: 34-35) The weaknesses of this system are similar to those of the weight-scaled checklist. Much information is lost in the aggregation process and many subjective judgments are hidden.

Another example of a mathematical matrix is the Component Interaction Matrix (CIM) developed by Environment Canada. It was used in an assessment of lumber transshipment sites in the Nanaimo River estuary in British Columbia. (Shopley and Fuggle, 1984: 35-37) The CIM uses a set of matrices. The first matrix shows environmental components on both axes. This identifies dependencies among environmental components. Using network analysis and mathematical techniques, second and higher-order dependencies can be derived. This process is used to develop a "minimum link" matrix. The next step is to develop a "disruption matrix" which traces the impacts of each project component on all primary dependencies. The CIM method has not received much favourable comment. (Shopley and Fuggle, 1984: 35)

Not all matrices with evaluative capability are mathematical. A joint federal-provincial West Coast Offshore Exploration Environmental Assessment was conducted in 1984 and 1985 to assess the potential effects of offshore petroleum exploration on the coast of British

Columbia. During this review, a team of scientists from the B.C. Ministry of Environment, Canada Department of the Environment, and Canada Department of Fisheries and Oceans used a set of focusing matrices to identify and evaluate key issues. (Ministry of Environment, 1985). This approach addressed many of the problems associated with mathematical matrices. It is similar to the three-step matrix procedure proposed by Fisher and Davies (1973). It is discussed in detail here because it is not reported in the published literature.

Step 1 of this method was the preparation of two matrices. The first was a "Social and Environmental Focus Matrix - Marine Threats" which used a set of explicit "focusing criteria" (e.g. rarity, recreation use) to rate the importance of various species in the exploration area, e.g. sea otters, grey whales.

The second matrix was a "Social and Environmental Focus Matrix - Safety Hazards" which rated marine forces (wind, waves) against another set of focusing criteria (e.g. threats to human life, threats to engineered structures) to determine which forces represented significant safety hazards.

Using a simple rating scheme within the two Step 1 matrices, the multi-disciplinary team established a list of species and marine forces of greatest significance or concern, which was carried forward to Step 2. Detailed audit notes made the judgments going into the evaluations explicit.

Step 2 used an "Industrial Focus Matrix" to compare species and marine forces with a number of Exploration Activities to determine where interactions existed. Because the list of species and marine forces had been pre-screened, the Step 2 matrix was smaller and more manageable than it would have been otherwise. Exploration activities threatening the largest number of species, and which were themselves at risk from the greatest number of marine forces, were carried forward to Step 3. Again, detailed audit notes were provided.

Step 3 used a "Mitigation Focus Matrix" to assess interactions (selected as important in the Step 2 matrix) with respect to the level of knowledge about the effect, the potential for natural recovery, and the effectiveness of mitigation. This analysis was used to rate species as to the "Class of Concern". A Class I concern, for example, might involve an interaction affecting a certain species where the potential for natural recovery and the effectiveness of mitigation were judged poor. A similar exercise was performed to evaluate mitigative options for marine forces. All Class I concerns were carried forward to Step 4. Again, there were detailed audit notes.

Step 4 involved the development of a "Management Focus Table" which evaluated various ways of reducing or eliminating the concerns, including engineering, operations, regulations, legislation, regional planning, assessment, monitoring, baseline research, and demonstration projects.

Step 5 involved the joint development of a list of "Key Interactions and Their Suggested Management" which provided discussion and recommendations concerning the key issues. No attempt was made to aggregate the information. This was left to the federal-provincial panel and the decision-makers.

Comments

Matrices can be helpful in identifying possible concerns for scoping. Because they relate project actions to environmental components that might be affected, they are superior to checklists. They also have an advantage of displaying information in a simple format which gives the reader an overview of the potential effects. Various methods have been devised to simplify matrices which have made them more manageable to use.

As an evaluation tool, issue-focusing matrices such as those developed for the West Coast review have considerable promise. This method deserves further study and testing. It identifies and evaluates key issues, and provides an analysis of the various management solutions available to address these issues. It is explicit about value judgments made and could be extended to incorporate publicly-derived scoping criteria.

4.4 NETWORKS

Networks and systems diagrams are flowcharts which trace project effects from project actions to end effects. The assessor starts with a project action and identifies the types of initial impacts which might occur from this action. Next, each initial impact is examined and the secondary impacts which may be induced are identified. This continues until all effects are identified. The development of the network diagram is based on existing knowledge and past experience with projects of the type under consideration. (Westman, 1985: 142-148; Rau and Wooten, 1980; Lee and Koumjian, 1978: 55-57; Rees, 1976; Warner and Preston, 1974: 19-20)

As a method of identifying impacts, networks can be reasonably comprehensive. However, they become more difficult to follow and understand as they increase in complexity and detail. In addition, networks can suggest a large number of effects which are not likely to occur or which have minimal significance. Therefore, screening of these effects for significance is essential. (Westman, 1985: 142-148; Rau and Wooten, 1980; Rees, 1976)

The network approach relies on the knowledge of the network designer for the identification of effects. As a result, important effects may be missed if not perceived. In addition, networks are less useful in dealing with social and aesthetic effects where cause-effect linkages are less clear. (Bisset, 1980; Gilliand and Risser, 1977)

Some attempts have been made to quantify the links in the cause-effects network to evaluate the significance of issues. These methods tend to be heavily dependent on data, and are likely not appropriate at the scoping stage of EIA. (Shopley and Fuggle, 1984: 40)

Comments

The network approach has the ability to trace first, second, and higher order impacts for each project action. Despite its limitations, therefore, the network approach is a useful method for the identification function of scoping.

Networks provide a picture of the system of cause-effect relationships between project actions and end effects. This allows the assessor to see the role of initial project effects in the overall impact of the project, which helps to identify which effects might be most important. Networks are thus a useful method for the evaluation function of scoping. However, scoping criteria should be used to ensure that consistent criteria are used to evaluate the importance of issues.

Networks also have value for the focusing function of scoping. They organize information to show interactions among components of the environment. They identify relationships among issues and can assist in the clustering of issues into meaningful categories. (see Section 7.0)

4.5 OVERLAYS

The overlay approach consists of a set of transparent overlay maps, each displaying information about environmental or social components. These maps can be "overlaid" on each other to highlight overlaps or conflicts between projects and environmental factors. (McHarg, 1968; Munn, 1979: 43-48)

The overlay method does not guarantee that all potential impacts will be identified. Rather, once an impact has been identified, overlays can be used as an evaluation tool to define the potential spatial extent of the impact. (Munn, 1979: 43-48) An overlay map of the reservoir area of a proposed dam, for example, would show the spatial extent of flooding. Other overlay maps would identify environmental components within this area or dependent upon it (e.g. ungulate browsing areas). Various criteria can be used to evaluate the significance of the loss of this browsing area.

A variety of coding schemes have been built into overlay maps to rate the relative importance of different areas. (Munn, 1979: 45-48; Jain et al., 1977: 83) For example, the ungulate browsing area affected by flooding can be coded to show the importance of the resource, using a computer code (in computer overlay systems) or shading (in mapping systems). This coding highlights the relative importance of the browsing area affected. If the browsing area is important, this becomes an issue for further assessment. Several overlay maps can be overlaid and compared at one time, allowing an easy-to-understand presentation of resources and impacts. This can be helpful for evaluation.

Overlay mapping systems may require a considerable amount of data, and may be expensive where the geographic area is large or data is not available. Because of the extensive use of mapping data in planning studies, information may be available from existing resource analysis mapping programs. (Jain et al., 1977: 83) In fact, a variety of land-use planning techniques (capability analysis, suitability analysis, carrying capacity analysis) may provide information for the evaluation of the effects of projects on resources. (Veitch, 1978)

Comments

Overlay mapping is not a comprehensive method for identifying possible impacts, but is useful for defining the spatial extent of impacts. Considerable use is already made of overlay mapping in planning and EIA, and government databases are expanding. If these databases are available, the overlay method may be an economical and useful method for identifying resources affected by a project.

4.6 EVALUATION TECHNIQUES

Value judgments are part of every phase of the EIA process. In Section 3.2, it was suggested that while value judgments mus t be made, they should be made (1) with public involvement and (2) explicitly so that they are open to scrutiny.

A class of methods, referred to as "evaluation techniques", have been developed to improve the quality of value judgments. These techniques are designed to incorporate the opinions of experts and the public into the EIA analyses. (Shopley and Fuggle, 1984) Instead of eliminating subjective judgments, these methods seek to make subjective judgments explicit so that they can be 'objectively' considered in making EIA evaluations. They use various techniques (ranking, rating, weighting) to quantify the values which should be applied to decide which issues might be most important. To determine these weightings, some of the

methods use group techniques to ascertain collective preferences of groups, e.g. the Delphi Method (see Section 6.3).

The class of evaluation techniques is not well defined in the literature and includes a wide variety of methods. Some evaluation techniques are used within some EIA methods already discussed, such as weight-scaled checklists and mathematical matrices which use rating systems to evaluate importance and significance of impacts or resources.

A large number of evaluation techniques are described in the literature including weighting methods, sequential elimination methods, penalty models, sliding scales, ranking models, min-max models, Pareto models, pairwise ranking, multi-dimensional analysis, multivariate data analysis, The Simple Multi-Attribute Rating Technique (SMART), Planning Balance Sheet, Goals Achievement Matrix, Priority Trade-Off Scanning Matrix, Simple Trade-Off Matrix, Decision Analysis, multi-attribute utility theory, Surrogate Worth Tradeoff Method, dominance analysis, Concordance Analysis, Saaty Method, Technique for Order Preference to Ideal Solution (TOPSIS), SAGE Method, and other approaches. (Maclaren, 1985; Westman, 1985: 148-163; Hyman et al., 1984; Bakus et al., 1982; McAllister, 1980; Finsterbusch, 1983: 285-311)

One criticism with evaluation techniques is that the mathematical structure of the methods places constraints on the way the model can be expressed. You are not free to design a model to emulate a system, but are constrained by a rigid framework. (Holling, 1978: 70) This is true of some of the methods while others are more flexible.

Another criticism is that some evaluation techniques are excessively quantitative. They may involve complicated and computer-dependent procedures. Some techniques also use complex procedures for establishing value weights making the procedure appear unduly scientific and objective. This has the effect of obscuring value judgments from public and decision-maker scrutiny. (Shopley and Fuggle, 1984)

A more serious concern is that the quantification of public preferences (as attempted by some evaluation techniques) may not be feasible at all. For example, McAllister (1980: 263) states that

> "... our knowledge of what determines the welfare of society is entirely too weak to reduce it to mathematical equation... Thus all mathematical weighting formulas must be seen for what they are: simplified approximations that yield highly questionable results...."

The unfortunate result according to McAllister is that some evaluative methods try to substitute the judgments of planners or other experts for consultation with the public. (McAllister, 1980)

Not all evaluation techniques are complex, however. An example of a useful evaluation technique was suggested by Haug et al. (1984b). They proposed a worksheet for evaluating the importance of environmental issues to specific groups. A list of questions is asked of each person or group raising an issue to elicit information to determine at what threshold the impact becomes important:

- "Who is concerned about the issue?
- What are your chief concerns?
- What do you think will be affected by the proposed action or an alternative?

- What do you think will happen to whatever you are concerned about?
- Can you estimate the change you are concerned about in terms of its magnitude, direction, intensity, timing, duration, location, etc.?
- Specifically, why are you concerned about those changes?
- How will those changes affect you?
- How much change could you tolerate or accept?
- What is your 'threshold of concern', the point at which an impact becomes unacceptable (or acceptable) to you?
- What else will those changes affect?
- Can you put any numbers on your estimates or concerns?
- Can you quantify your concern in any way?"

The thresholds of concern, once identified, can be compared with estimated environmental changes to evaluate whether the effects would be considered significant, given the citizens' values. The results are reported in a worksheet which tracks who is concerned about the issue, their thresholds of concern, and any changes in judgment as the process proceeds. No reports of field tests of this method could be found, but the method may be worthy of further study. The use of thresholds possibly over-simplifies the process citizens use to evaluate the significance of issues; citizens who oppose a project may not commit themselves to a threshold which would make their concern unworthy. There may also be a tendency to suggest low thresholds so that the effect would be important at a low level of impact. However, the use of a worksheet and explicit questions provides interesting possibilities as a means of exploring the basis of citizen concerns.

Comments

Evaluation techniques, as the name implies, are primarily useful for the evaluation of issues. They are not intended or designed for the identification of concerns. As scoping methods, many evaluation techniques are too complex and hide too many subjective judgments. However, given the large number and variety of evaluation techniques, with some reported successes, these techniques should not be rejected overall. Rather, some of these methods, such as the Haug et al. method, have promise for particular situations and should be explored further. However, if evaluation techniques are used for scoping, attention should be given to methods usable for decisions in the public arena. Bakus et al. (1982) argue that simple methods may be as accurate as more complicated methods, and that people distrust 'black boxes' where value judgments are hidden.

4.7 ENVIRONMENTAL MODELLING

An environmental model is a simplified representation of an environmental system. It uses conceptual and quantitative techniques to model the functional and dynamic relationships in the environment. Models can be conceptual or quantitative. Conceptual models are often descriptive in nature. Beanlands and Duinker (1984: 19) define conceptual modelling as

"an organized exercise of: (i) identifying the relevant system components, (ii) quantitatively identifying the system structure, and (iii) developing a flow diagram of the system. The main purpose for the conceptual model is to explicitly organize the preliminary understanding of ecological structure and function (i.e. components and processes)".

Development of a conceptual model is often a preliminary step in developing a quantitative model. (Westman, 1985: 95) Quantitative modelling, as defined by Beanlands and Duinker (1984: 19), is

"...the construction and use of mathematical representations of ecological phenomena and relationships. As such it may involve statistical analyses, simulation modelling, and several other forms of mathematical manipulation of data."

Environmental models are valuable for the identification function of scoping. Because they explore how an environmental system operates, they help in understanding how a project might affect that system. (Shopley and Fuggle, 1984: 42; Valiela, 1984) This assists in the identification and prediction of effects. A model can also be subjected to "what if" questions to test the sensitivity of various theories or hypotheses to changes in the model structure or variables. This helps to isolate the important relationships from the "noise" in the system (e.g. natural variations). (Beanlands and Duinker, 1983: 19, 53-55; Fritz and Rago, 1980; Munn, 1979: 59; Holling, 1978: 50-51, 66-69; States et al., 1978; Rees, 1976: 70-73)

Environmental models are also helpful in the evaluation stage of scoping. As Holling suggests, they provide a focus for deciding what important relation- ships exist within an environmental system:

"In interdisciplinary discussions that do not have such a focus, much time is wasted in general discussions of what is 'important'. When factors are brought into the open and quantified as part of a larger model, their importance can be judged by all the workshop participants. It should not come as a great surprise that many specialists find modeling workshops exceedingly painful: many of the 'important' factors always turn out to be irrelevant for prediction." (Holling, 1978: 50)

Thus modelling uses professional judgment in the context of a dynamic model to judge which processes are important in an environmental system. (Holling, 1978: 54) This provides the basis for evaluating the importance of issues.

Beanlands and Duinker (1983: 53-54) found agreement among workshop participants and the literature that modelling is a useful and appropriate tool for EIA. However, they also found that the actual use of models was limited and sporadic. They attribute this to two perceptions. First, models are considered by many to be unnecessary for an adequate assessment. Second, models are often perceived as being difficult to develop. Some of the perceived difficulty may be due to the early experience with ecological modelling, which was characterized by attempts at very large, detailed models of complex environmental systems. Present practice calls for ruthless pruning of irrelevant variables and parsimony in the design of the models. (Bisset, 1980; Holling, 1978: 51; Shopley and Fuggle, 1984: 42; Rees, 1976: 71)

Another concern with environmental models is that models are a simplification of a real world system. Often, unforeseen factors can play a part in causing real world results to depart from model predictions. Models should therefore contain testable hypotheses or predictions so that monitoring and research can be used to test the assumptions upon which the model is based. (Holling, 1978: 95-105; Westman, 1985: 97)

Modelling may not be as useful for the identification and evaluation of socio-economic issues. In an environmental system, natural processes are determined by natural forces, which while not certain, are at least deterministic. In social systems, the elements of human will, values and expectations become causal factors, introducing considerable uncertainty.

Finally, there is concern that small workshops with limited public consultation, which often characterizes modelling efforts, leaves many assumptions unchallenged (see Section 6.6). (Bisset, 1980)

Comments

Environmental models have a role in the identification stage of scoping. They are especially important in the identification of secondary and higher-level biophysical impacts.

Environmental models also have a role in the evaluation stage of scoping. Because these models explore interrelationships among important species and processes in the environment, they can highlight which impacts are likely to be significant. If this evaluation is based on publicly-derived scoping criteria (see Section 3.2), modelling can be responsive to public preferences. However, as noted in Section 3.2, it is necessary that the judgments going into modelling be explicit and that the public have a means of participation at critical stages in the model-building process.

Because models identify the many cause-effect sequences which occur when a project is developed, they are especially useful for the focusing function of scoping. By identifying linkages they assist in clustering issues into categories with merit in a systems sense. (see Section 7.0)

4.8 ADAPTIVE METHODS

Adaptive methods are a combination of procedures, concepts and approaches with a common theme of recognizing uncertainty as the dominant component of environmental issues. (Holling, 1978; Sonntag, 1983; Jones and Greig, 1985: 21-42; Westman, 1985: 95-97)

The most widely applied adaptive approach is the Adaptive Environmental Assessment and Management (AEAM), developed in the early 1970s. (Holling, 1978) It applies systems analysis ideas and methods to address uncertainty. Matrices and other traditional EIA methods are suggested as preliminary analysis methods for identifying issues, while computer simulation modelling of environmental systems is recommended as a prediction tool. (Holling, 1978: 54, 71ff; Shopley and Fuggle, 1984)

Interactive modelling workshops are used to involve analysts, scientists, and decision makers in designing the simulation model. (see Section 6.6) These models provide a focus for integrating knowledge about the environmental system. (Holling, 1978: 50; Sonntag, 1983; Jones and Greig, 1985: 36-41).

A modified AEAM approach was used recently to improve research and management decision-making for resource management in the Beaufort Sea region. The AEAM approach was adapted to incorporate the findings of Beanlands and Duinker (1983) in their study of the scientific basis of EIA. (Everitt et al., 1986) This exercise assisted in the identification and evaluation of key resource management issues and scientific research priorities in the Beaufort Sea. The modified approach also been tested in other situations with some success.

Comments

To a large extent, every EIA today uses adaptive assessment methods. EIAs are usually conducted with interdisciplinary teams who use a variety of methods to identify and evaluate environmental issues and impacts. A primary concern is how to cope with uncertainty. (Shopley and Fuggle, 1984: 44-45)

As a scoping tool, the adaptive approach often uses a combination of EIA methods (matrices, models) in identifying concerns. However, issues are primarily identified by scientists in a workshop setting. Modifications have been made to ensure public access to this process through "social scoping". (Beanlands and Duinker, 1983; Everitt et al., 1986)

The adaptive approach normally uses simulation modelling and expert judgment to evaluate the significance of issues - thus relying on expert judgment. As suggested in Section 3.2, such judgments should be made explicitly and with public input. While a simulation model may be somewhat esoteric, it does make the basis of some judgments explicit. Further modifications are needed to ensure opportunity for public input.

5. PUBLIC PARTICIPATION METHODS

The Canadian Environmental Assessment and Review Process (EARP) requires initiating agencies to consider public concerns regarding proposals and their environmental effects. (Duffy, 1986: 8) Agencies and proponents are sometimes hesitant to involve the public early in a scoping process. They fear this may alert citizens to the project and allow the opposition time to organize against it. (Grima, 1985; Beanlands and Duinker, 1983: 37-39) Various methods may increase or decrease conflicts in a public involvement program. Methods used in scoping should try to achieve consensus on the important issues in a review.

Some early scoping efforts were criticized for failing to contact all significant affected interests, thereby risking the possibility that key issues will not be identified. This would affect the credibility of the scoping process and lead to demands for further meetings and consultation. (Sachs and Clark, 1980: 24-25, 36-37) Appendix B describes methods of identifying groups which should be involved in a scoping process.

Various public participation methods are available to assist in identifying and evaluating concerns of the public about a project proposal. (Duffy, 1986: 18-19; Grima, 1985) Although much has been written on public participation, this section highlights a few methods which may be useful for scoping, including public meetings and hearings, open houses, networking, hotlines, surveys, advisory councils, and content analysis.

5.1 PUBLIC MEETINGS AND HEARINGS

Public meetings and hearings are the most common and traditional technique of public involvement. The difference between a meeting and a hearing is that the latter is more formal and is often a requirement of legislation or regulations. (Grima, 1985; Sachs and Clark, 1980: 79)

Public meetings are a useful forum for citizens to raise their concerns about a project. This assists in the identification function of scoping.

While discussions at public meetings may help a panel or initiating agency to identify public concerns, public scoping meetings may not achieve consensus on key issues. Public meetings have been criticized for stimulating unnecessary controversy. They have been called "the last of the blood sports..." (Connor, 1982) Public meetings are often seen as a public relations exercise allowing a proponent to sell a project, but they may also give advantages to vocal and well-organized opponents. In either case, they are dominated by one-way exchanges allowing little room for creating consensus and understanding. (Grima, 1985; Sachs and Clark, 1980: 23, 70-77, 79)

When a public review is carried out under EARP, scoping normally takes place at the guidelines preparation stage. In recent reviews, public meetings have been held to provide an opportunity for local residents to identify and discuss what issues should be addressed in a review. These meetings have been successful in the identification function of scoping, so that in recent reviews, most issues have been raised early and appear in EIS guidelines. However, these meetings have been less effective in evaluating the importance of the issues. Few unimportant issues have been eliminated. (Ross, 1986; Marshall and Wolfe, 1986)

In the United States, Sachs and Clark (1980: 9, 66-68) found that one or more public scoping meetings were usually held to involve the public in scoping. At these meetings, citizens were encouraged to present their concerns and an attempt was made to assign priorities to

perceived problems. (Beanlands, 1986) A typical meeting began with a short briefing on the proposal which was usually supplemented with an information packet and followed by a question period. In many cases, attendees were allowed to make presentations identifying the impacts they felt were important. In some of these meetings, there was dialogue to discuss the importance of the issues. Sometimes the agency representatives simply listened to the testimony without response, occasionally asking questions of clarification. (Duffy, 1986: 17-18, CEQ, Yost, 1981; Sachs and Clark, 1980: 9, 66-68; Bureau of Land Management, 1984)

Despite some criticism, public meetings and hearings are relatively inexpensive and easy to organize. They are able to reach a large audience and provide a written record for public scrutiny. They allow an airing of opinion and expose project proponents and decision-makers to public questioning. (Grima, 1985) For these reasons, public meetings will continue to be used for scoping.

In addition, several improvements have been suggested to increase the effectiveness of public meetings and hearings. These include intervenor funding, careful planning of meetings, training of chairmen, responding to public concerns, opportunities for interest groups to commission independent peer reviews of technical reports, and videotaping of sessions to discourage grandstanding. (Grima, 1985; Yost, CEQ: 1981)

Comments

Public meetings and hearings are useful methods for identifying concerns as part of the identification function of scoping. They are not as useful for evaluating which issues are the most important. Group process methods reviewed in Section 6.0 may provide ways of making meetings more effective at evaluating issues. In a relatively unstructured public meeting, however, limited improvements can be made to enable better evaluation of issues (see above).

5.2 OPEN HOUSES

An open house is a scheduled opportunity for members of the public to drop in and discuss a proposal with representatives of the review agency, the proponent, or both, who are on hand to meet people as they arrive. The typical open house is held at an accessible location and time of day (usually afternoon plus evening). Information is provided to the public in hand-outs and display panels. Feedback is obtained by staff present at the open house, who write down comments from the public. In addition, some form of questionnaire is used to allow the participants to record their response. (Connor, 1982)

Open houses have been held as part of scoping processes in Canada, e.g. Point Lepreau Nuclear Reactor Expansion, Eldorado Low Level Radioactive Waste Disposal. They have usually been held by panel secretariats in the area of the project in conjunction with public meetings or scoping workshops. (Ross, 1986) These sessions have not been evaluated in the literature with respect to their effectiveness in identifying and evaluating issues.

An open house is an effective method for a review agency or proponent to establish two-way communication with individuals concerned about a project. It provides information on which issues are most important in a review. It is also a valuable opportunity for staff of the review agency to provide information to the public on the review process itself. However, as a scoping exercise, open houses have not yet been adequately evaluated.

5.3 NETWORKING

In a networking approach, the review agency or proponent places field workers or community liaison staff in local communities and neighbourhoods to exchange information with the community about a project. Field workers can meet with citizens in a natural setting where mutual exchange is possible. They develop routine contacts within the informal networks of people in the community. In this way, they can identify the concerns of citizens and understand the context and significance of these concerns to community groups and individuals. (Preister and Kent, 1981) At the same time, they can provide information to the community about the project or the review process. Waiten (1981) suggests that field work is especially necessary in contexts such as native communities where society is consensual and ideas are exchanged in an informal and unstructured manner. In networking approaches, it is essential that the field workers have skills with people so that they are readily accepted by the community.

Networking provides a useful way for review agencies and proponents to identify concerns and learn about the reasons for these concerns. Understanding the reasons for concerns can help in evaluating their importance. Field offices have been established by proponents and by EARP panels as part of the EIA reviews. It may be useful to establish these offices early in the process to assist with scoping.

5.4 HOTLINES

A hotline is an advertised special telephone number which members of the public can call to discuss issues they feel are important. A staff member of the initiating or review agency can be designated by name to ensure continuity and rapport. The hotline can be used to take public comments before, after, or instead of a public meeting.

A hotline is an effective means for citizens to raise their concerns with the initiating or review agency. (CEQ, Yost, 1981) It may also provide information which would assist the evaluation of the importance of issues. A hotline is therefore a useful tool for scoping to be used in conjunction with other tools.

5.5 RESPONSIVE PUBLICATIONS AND SURVEYS

The responsive publication or opinion survey is usually a relatively open-ended document providing information about the project and inviting comments, suggestions and questions. The distribution should be as wide as possible, perhaps published in the local newspaper. (Connor, 1982) A more formal opinion survey can also be used to identify relevant groups, their concerns and the nature and strength of their support or opposition. They can also be used to "get a reading" on the opinions of the public that does not get involved. (Whitney and Maclaren, 1985: 4-8)

Responsive publications and surveys are valuable methods for identifying public concerns. Given appropriate design, a survey can also provide information on how affected persons rate the importance of the issues, thus aiding the evaluation of key issues. Thus this approach is a useful method for scoping.

5.6 ADVISORY COUNCILS

Agencies and proponents are often concerned that those who become involved in an assessment may not be representative of the general public. They may thus dismiss the concerns of involved citizens as biased by the Not-In-My-BackYard (NIMBY) syndrome. (Lang, 1979: 96) In fact, there are two groups: the affected public and the rest of the public. Often people become involved because their interests directly affected by a project. Because they can be injuriously affected, the legal principles of natural justice require that they have an opportunity to speak to the issues. Other citizens may also have opinions and concerns, but these are often not expressed.

Grima (1985) suggests the appointment of an advisory body (e.g. consultation panel, advisory board, citizen task force) to obtain input from the wider community. He suggests that all affected interests who identify themselves should be involved in the public process. However, these groups should be supplemented by a jury or panel of individuals selected at random from the community to best represent, at least statistically, the general public. This would broaden the representativeness of a public involvement process. Meetings of the advisory body would occur over a period of time (a few weeks to a year or two) and allow for extensive interaction. An example of an advisory body is the seventeen participation panels in the Reference Group on Pollution for Land Use Activities concerning the Great Lakes set up by the U.S.-Canada International Joint Commission.

Sachs and Clark (1980: 31-41) describe the use of an advisory panel consisting of conservation groups and federal agencies to scope a review of the U.S. Fish and Wildlife Service's Endangered Species Program. The meetings were held in public, and members of the public were able to dialogue with the panel. The meetings were recorded.

A criticism of the advisory council approach is that members may become co-opted as they become "official participants" and develop a sense of loyalty to those who appointed them. This may make the process less open and accountable. (Grima, 1985) Sachs and Clark (1980: 37-41) also note that, in the Fish and Wildlife Service example above, the approach was not successful in focusing on important impacts. No group consensus developed on the issues which would be part of the EIA and subsequent policy. Further, the linkage between scoping, the EIS, and agency policy-making was not strong.

Advisory councils provide a forum for identifying and evaluating. Thus they are one approach for organizing a scoping program. However, the quality of the scoping results are likely to depend on the procedures followed at the meetings of the advisory council. Group process methods are discussed in Section 6.0.

5.7 CONTENT ANALYSIS

Content analysis is a technique for systematically analyzing the content of documents which record written or oral messages. The methodologies for content analysis are well established. (North et al. 1963)

Content analysis is a useful method for identifying public concerns. Grima (1985) argues that public input should be subjected to detailed and comprehensive evaluation including the content analysis of briefs, letters and other responses. Content analysis was used for scoping in the Beaufort Sea environmental assessment under EARP. All documents received by the Panel were indexed in an "Information Survey" with original documents available to the public in a "Public File". In addition, excerpts were taken from briefs and hearings transcripts and sorted by issue into a "workbook" for use of the panel. As a result, valuable

information was provided to the Panel on the issues raised by the public. (Beaufort Sea Panel, 1984; Wolf, 1983; Marshall and Wolfe, 1986)

The use of content analysis in scoping depends on the availability of source documents such as briefs and transcripts where the public identifies its concerns. Early scoping exercises, such as public meetings, open houses, or responsive surveys can be used to provide these documents. Public briefs can be solicited. Another approach is to analyze the content of news articles, agency files and other reports of citizen opinion. (Connor, 1982)

Content analysis is a proven and useful method of identifying public concerns. It also reviews the reasons for these concerns, which helps in the evaluation function of scoping. This is especially true if scoping criteria are used together with content analysis. Appropriate content analysis procedures should be developed and used in scoping programs.

6. GROUP PROCESS METHODS

A number of group process methods have been used for the identification and evaluation functions of scoping. Because scoping is a social as well as an analytic process, methods which enhance the effectiveness of group processes can also improve scoping. Small group dynamics is a major field of study, and a review of that literature is not possible in this paper. However, some common methods are presented, including interacting group meetings, brainstorming methods, Delphi method, Nominal Group Technique, mediation, and model building workshops.

6.1 INTERACTING GROUP MEETINGS

Interacting group meetings are the type of meeting familiar to most people. A meeting is called, someone becomes the chairperson, and the meeting process is regulated by a set of formal rules (e.g. Robert's Rules of Order, court procedure) or by informal "give-and-take".

Interacting group meetings are perhaps the most common method used for scoping. A review panel or the staff of an initiating agency meet to identify concerns or evaluate the significance of issues. The meeting is not structured and a give-and-take process occurs. (Duffy, 1986: 17)

The effectiveness of an interacting group meeting for scoping depends directly on the quality of the interaction in the group and on how well the meeting is managed. (Greene, 1986) Unfortunately, in many such meetings, there is a tendency for the more vocal, articulate, and expressive individuals to dominate. Differing statuses of participants may also inhibit participation or affect the direction and quality of discussion. (Van de Ven, 1974: 16, 98; Delbecq et al., 1975: 31) These factors may bias the identification of issues in favour of the position of the "high profile" participants. The high profile members can also impose their judgments about the importance of issues on the group.

Interacting groups also suffer from the bandwagon effect (also known as groupthink). The bandwagon effect occurs when group members become fixed on a certain idea or train-of-thought. Doubters stop voicing criticisms. Members avoid raising of new ideas because of the fear of criticism, desire for conformity, or simple contagion with the present train-of-thought. The result is that the group seeks a speedy solution before all of the issues have been considered. (Delbecq et al., 1975: 16-17, 23-26) In a scoping program, this may result in a narrow identification of issues and premature judgment as to which issues are most important in the review.

Another reason why meetings are often ineffective is that members may not concentrate effectively on the task at hand. They usually focus on the problem for short periods, tending to avoid tasks and engage in tangential discussions. Ideas are expressed as generalizations. Much of the interaction is concentrated on establishing or maintaining social relationships. These aspects mean that interactive groups have a positive role in increasing group identity, consensus and other motivational purposes, but are not effective for creative issue identification. (Delbecq et al., 1975: 31-33)

A major reason for the failure of many interactive group meetings is the variability in leadership and group skills. (Delbecq et al., 1975: 15, 31) On the other hand, with effective leadership, performance of interactive groups can be significantly improved. An effective chairman can restrain vocal participants from dominating the group and ensure that everyone has a say. He or she can also insist that new ideas be given fair consideration,

discourage premature focusing on solutions, pull the threads of a discussion together and lead the meeting toward a consensus when consensus is required. (Greene, 1986) Effective chairing skills can thus improve the effectiveness of interacting group meetings in achieving group objectives, including the scoping of EIAs.

Comments

Interacting group meetings will likely continue to be a dominant method for identifying and evaluating issues in scoping processes. If for no other reason, they are a familiar and culturally accepted way of making decisions. Accordingly, it is important that this venue for scoping be made as effective as possible. First, close attention should be payed to the chairing function, including the skills and effectiveness of those who chair scoping sessions. Similar attention should be given to the group skills of participants if they are part of a regular scoping team. Careful team selection may greatly assist the scoping process. (Miller, 1984) Second, training should be available to the chair and members of scoping groups, to improve group skills and ensure that the worst abuses of group process can be avoided. Given these prescriptions, group meetings can continue to play a useful role in scoping programs.

6.2 BRAINSTORMING METHODS

Alex Osborn has been credited with refining a group process referred to as "brainstorming" - a term which has earned its way into the dictionary. Osborn first used the process in 1938, but he indicates that it has been used in India for over 400 years. The best use of brainstorming is for generating creative ideas. In the context of scoping, it is a method for identifying concerns and issues. It is not effective for the evaluation function of scoping.

Osborn (1953) described brainstorming as

> "nothing more than a creative conference for the sole purpose of producing a checklist of ideas - ideas which can serve as leads to problem-solution - ideas which can subsequently be evaluated and further processed."

Osborn stressed that

> "too many have erroneously regarded group brainstorming as a complete problem-solving process, whereas it is only one of several phases of idea-finding; and idea-finding is only one of the several phases of creative problem-solving." (151-152)

Osborn considered brainstorming an idea generation process rather than an evaluative process. In fact, a fundamental principle of brainstorming is that participants must defer judgment on the subject matter until the session is complete. The brainstorming process, in fact, is simply a group process, familiar to most people, which involves participants throwing out ideas, which are then recorded, usually on flip charts or other media, for all to see. Osborn argued that brainstorming feeds the process of association among ideas and creates a form of idea contagion.

Osborn (1953: 156) prescribed a set of four rules which must be understood by all present, and faithfully followed, during the idea generation session for the process to be effective:

(1) "Criticism is ruled out. Adverse judgment of ideas must be withheld until later.

(2) 'Free-wheeling' is welcomed. The wilder the idea, the better, it is easier to tame down than to think up.

(3) Quantity is wanted. The greater the number of ideas, the more the likelihood of useful ideas.

(4) Combination and improvement are sought. In addition to contributing ideas of their own, participants should suggest how ideas of others can be turned into better ideas; or how two or more ideas can be joined into still another idea."

Comments

Although brainstorming is not designed for evaluation of ideas, it is very effective at generating a large number of ideas. This means that brainstorming is a useful tool primarily for the identification function of scoping. However, a disadvantage of the brainstorming method is the potential for groups to get carried in a certain direction by "bandwagon effects". (Roper, 1986) As described in Section 6.1, this could damage the effectiveness of issue identification. However, because of its wide use, brainstorming is generally understood by most people, whether citizens or experts. It will therefore continue to be used for idea (or issue) identification.

6.3 THE DELPHI METHOD

The Delphi Method was developed in 1950 by the Rand Corporation for the U.S. Air Force in order to obtain a collective opinion of a group of experts (a respondent group) on management problems. It is now "one of the most popular techniques of behavioral interaction in decision making...." It is readily combined with many sophisticated decision analysis techniques, including the use of probabilities and cross-impact analysis. (Bakus et al. 1982)

The Delphi method could be useful for both the identification and evaluation functions of scoping. According to Delbecq et al. (1975: 10) "The Delphi Method is a method for the systematic solicitation and collation of judgments on a particular topic through a set of carefully designed questionnaires interspersed with summarized information and feedback of opinions derived from earlier responses." It is not a "meeting" process. The respondent group, who are experts from whom ideas and judgments are sought, are not brought physically together and do not meet for face-to-face group discussion. Rather, the Delphi Method uses a sequence of alternating questionnaires and feedback reports to gather ideas and judgments from respondents who may be in widely different locations. The process is guided by a "monitor team" or coordinator. (Van de Ven, 1974)

There is considerable variation in how the Delphi Method procedures are used. However, the general sequence of events is as follows (Van de Ven, 1974; Bakus et al. 1982):

(1) Idea Generation. A monitor team sends a questionnaire usually with open-ended questions to a respondent group consisting of several experts. The experts usually do not know the identity of other experts in the respondent group. Each respondent answers the questionnaire and provides pertinent explanatory information.

(2) Synthesis. The monitor team receives the completed questionnaires and develops a report collating and pooling the judgments of the respondents. This report provides an interpretation of how members of the respondent group view the issues, their agreements and disagreements, and the bases for their value judgments.

(3) Feedback. The monitor team's report is fed back to the respondents for further comments, along with a second questionnaire. This questionnaire provides for independent voting on priority ideas by a rank order procedure.

(4) Final Synthesis. The monitor team receives the completed questionnaire and prepares a final report summarizing the data and using the voting results from the respondent group.

There is debate about whether participants need to be anonymous, whether open or closed-ended questions should be used, and how many iterations of feedback and synthesis should be done. There is also no standard procedure for voting, weighting or ranking. (Delbecq et al., 1975: 11; Bakus et al. 1982)

Because of the isolated generation of ideas in writing, the Delphi Method generates a large number of ideas. In addition, because the writing of responses to questions forces respondents to think through the problem, Delphi also tends to result in specific, high-quality ideas. Because group members are isolated from each other, ideas tend to be original rather than reactive. Isolation also avoids dominance of the process by individuals, group pressure, conformity and bandwagon effects. (Delbecq et al., 1975: 35) Delphi stresses anonymity, controlled feedback, and a statistical evaluation of responses. (Bakus et al. 1982) Thus it addresses some of the drawbacks of the brainstorming method.

Delphi may be a practical method for group input in situations where participants cannot be assembled in the same place. This may result in cost savings in travel and respondent's time, although administrative time requirements may be greater. (Delbecq et al., 1975: 12, 29-30, 35; Van de Ven, 1974) On the other hand, Delphi requires more calendar time when compared to other methods, because of its dependence on correspondence. (Delbecq et al., 1975: 29-30; Van de Ven, 1974; Bakus et al. 1982).

Delphi has some disadvantages. The selection of respondent group members can bias the results. The results can also be biased by the content of the report of the monitoring team. (Bakus et al. 1982) Delphi is weak in developing group perspectives or consensus on issues, It also relies on simple aggregation of judgments without verbal clarification or discussion to resolve differences, so it does not resolve conflicts. (Delbecq et al., 1975: 12, 35; Van de Ven, 1974) These disadvantages may be problematic if the goal is to achieve an unbiased consensus on which issues are the most important in a particular EIA.

The interagency referrals process is an example of a Delphi-like procedure used heavily in Canada. In a referrals process, agencies considering projects "refer" information about these projects to a selected list of agencies for comment. This allows agencies to identify their interest in the proposals. A further modification of the process is being implemented by the Fraser River Estuary Management Program, which involves a coordinated referrals process using common forms and a computerized notification system. (see Fraser River Estuary Study, 1982; O'Riordan and Wiebe, 1984; McDougall, 1982; Reith, 1982)

Comments

Delphi has potential as a method for scoping EIAs. It is an economical way of identifying concerns, and coupled with appropriate analytic methods, it can obtain evaluative opinions from a cross-section of scientists, government agencies or interest group spokesmen. The techniques of Delphi are well developed in other fields, and the method has many successful applications. Further use of this method should be encouraged. It would be especially applicable in the very early stages of scoping, perhaps at the screening stage, where initiating agencies are seeking an expeditious and economical sounding of expert opinion and judgment.

6.4 NOMINAL GROUP TECHNIQUE

The Nominal Group Technique (NGT) was developed in 1968 by Andre L. Delbecq and Andrew H. Van de Ven. According to Van de Ven (1974), NGT is a "structured group meeting in which individuals work in the presence of others but do not verbally interact for a period of time." NGT is based on the observations that small groups in which participants do not interact are best for idea generation, and small groups which do interact are best for idea evaluation. NGT allows periods for non-interaction and interaction in a controlled sequence.

Delbecq et al. (1975: 117-123) discuss the use of NGT in citizen participation contexts, where it has had considerable success. (Roper, 1986) More specifically, NGT has been used in EIA scoping exercises in the United States. Sachs and Clark (1980: 21-23, 55-59) describe the use of versions of NGT in scoping issues in an oil refinery review carried out by the Army Corps of Engineers (ACE) and in a pipeline review carried out by the Bureau of Land Management (BLM).

NGT has also been applied with groups of multi-disciplinary and multi-agency experts. It allows balanced participation of experts from widely varying disciplines, encouraging cross-disciplinary understanding and perspectives to develop. (Delbecq et al. (1975: 124-137; Greene, 1986)

While NGT involves face-to-face discussions, these discussions are sequenced in a structured manner to avoid bandwagon effects and domination by individuals. Participants are allowed to know who has suggested various ideas and discuss the evaluations made by other participants. (Delbecq et al., 1975: 24; Roper, 1986) NGT consists of the following steps (Van de Ven, 1974; Bakus et al. 1982; Roper, 1986):

(1) Silent Idea Generation (10 to 25 minutes): Individual group members work silently but in the presence of the group. On a pad of paper, they list ideas and factors they consider important to the study.

(2) Group Round-Robin Listing of Factors (45 minutes to one hour): Each participant, in sequential order, reads one idea or factor from his or her own list without explanation or arguments in support. These are written on flip chart. No discussion, questions or comments are allowed from the group. The listing continues around the room until each member indicates he has no further ideas to share.

(3) Discussion and Clarification of Listed Factors: Each listed item is discussed informally by the group in sequence with the objective of clarification. The group leader controls the discussion to prevent dominance by vocal individuals. Additional factors can be added to list. Factors may be combined to reduce repetition and overlap.

(4) Silent Individual Written Voting on Priorities: Each participant is asked to select, silently and independently, the most important factors from the common list. A decision must be made (in advance) on voting or ranking procedures (see below). This is not a final list but a movement from broad issue identification to focusing on the most important factors. Votes are tabulated and placed on the flip chart.

(5) Discussion of voting results (about 30 minutes): The results of the first round of voting are presented to the group and discussed. Usually, they find that the initial ranking of issues unsatisfactory. This sharpens their focus on the most important factors and focuses on evaluative criteria. New factors are proposed to encompass the concerns of the group. New categories are formed which identify major areas of concern. Group cohesion is usually evident.

(6) Final, Silent Individual Written Voting: For a second time, participants are asked to select (silently and individually) the most important factors. Factors should be selected from the entire list without regard to preliminary ranking so the flip chart with preliminary rankings should be removed. Again, a decision must be made on the voting or ranking procedure.

There are several alternative procedures for voting, weighting or rating of issues in NGT. This gives NGT an evaluative capability which is useful for the evaluation function of scoping. Delbecq et al. (1975: 54-66, 74-75) and Roper (1986) present alternative voting schemes which have been tested in various contexts. Similar approaches were used by the Bureau of Land Management and the Army Corps of Engineers in their scoping of issues noted above. (Sachs and Clark, 1980: 22, 26)

NGT has been compared empirically with Delphi and interacting group processes. (Delbecq et al., 1975: 16-19, 33-34; Van de Ven, 1974; Bakus et al., 1982) These studies have found that NGT is very effective at generating ideas - almost twice as effective as interacting groups and slightly more effective than Delphi. This is due to the alternating periods of generating ideas and clarifying. This suggests that NGT may be a superior method for the identification function of scoping.

In addition, participants have expressed significantly higher levels of satisfaction than did participants in interacting group and Delphi processes. NGT provides a balanced recognition of the task and social functions of the group. (No significant difference was perceived in group satisfaction between interacting and Delphi techniques.) NGT solicits the broadest range of ideas and makes those ideas the common property of the group. It builds group consensus and increases acceptance of results. It keeps the meeting process on track (avoids tangents). It avoids dominance by strong individuals, avoids suppression of new ideas and minority opinions, and ensures all participants have input to the decision. This consensus-building capability is helpful in scoping, where an objective is achieving agreement on which issues are most important in a review.

In social research and citizen participation applications, Delbecq et al. (1975: 108-120) have found that NGT is effective in clarifying the nature of social issues, and in exploring the objective and subjective (emotional) dimensions of issues. It also facilitates the development of hypotheses and the formulation of questions for survey and interview field research. NGT allows research subjects and citizens to identify critical problem dimensions in a non-threatening and depersonalized manner. It reduces destructive forms of interaction and reduces some of the disadvantages of mixing professionals and citizens. If used early in the process, it can allow citizens to define the issues which form the basis for further policy work by professionals. These factors suggest that NGT has a role in scoping socio-economic issues.

Although NGT has proven value for the identification and evaluation of issues, it also has disadvantages. As with any group process, poor selection of the group can bias the results. Although NGT is designed to control group behaviour, there is still the possibility that high status or aggressive persons may dominate. Also, where participants come from divergent backgrounds (language, culture, scientific discipline), misunderstandings may occur. In a public forum if voting determines the weight assigned to issues, meetings can be packed to inflate relatively minor concerns. At the same time, persons with minority concerns may be alienated if their concerns are discounted. In the BLM case discussed above, many participants in the nine meetings did not participate in the voting process for unstated reasons. Some individuals may not be comfortable with a structured meeting, although this process has been successful in a variety of contexts including public meetings. (Bakus et al., 1982; Sachs and Clark, 1980: 29, 59-62)

Delbecq et al. (1975: 34) indicate that some preparation is required to prepare for NGT meetings, including identification of meeting products desired and providing necessary supplies. In addition, because a group must be assembled, there may be logistical problems and costs. Therefore, NGT is not a spontaneous technique. Nor is NGT flexible while in progress because it is difficult to change topic in mid-meeting; this makes an NGT meeting a single-topic meeting.

Comments

The Nominal Group Technique is a strong method for scoping. It identifies concerns with minimal bandwagon effects and domination by vocal individuals. Studies have shown that NGT generates a large number of ideas. This makes NGT an ideal method for the identification function of scoping.

At the same time, NGT has a built in evaluative capability. It is adaptable to a variety of weighting, voting and rating techniques, and builds consensus on the issues which are important. This makes NGT ideal for the evaluative function of scoping.

The one drawback is the reluctance of some citizens to participate in a structured meeting. The reasons for this are not clear, and further analysis should be undertaken to determine why this is the case. This analysis could include an exit survey of participants and non-participants in a structured NGT scoping meeting. In conclusion, NGT has significant advantages over interacting group meetings for scoping. NGT should therefore be considered an important method for scoping.

6.5 MEDIATION

Two groups are usually involved in EIA reviews: those favouring a project and those opposed. These groups naturally view the issues differently. The pro-project groups tend to downgrade negative issues and highlight the positive. The opponents tend to highlight questions and issues which may lead to rejection of the project. Each side feels the other may misuse the identification and evaluation of issues to further its position.

Although several of the methods discussed in this paper seek to achieve a consensus among participants on what the important issues are, most do not directly address the fundamentally opposing positions of the participants. Environmental mediation offers an alternative approach. It focuses on the antagonistic positions of the participants, bringing these participants together to "negotiate" their differences. (Grima, 1985; Greene, 1986; Marshall et al., 1986) The process may be moderated by a neutral and unbiased mediator with expertise in bargaining and mediation. He should also be familiar with environmental assessment methods and the policies of the various agencies. (see also Wolfe, 1982a: 30-36)

The mediator attempts to get the two parties to agree on the substantive matters upon which they disagree, or at least narrow and focus their differences.

Emond (1986: 57) notes that the Ontario Environmental Assessment Board is experimenting with pre-hearing mediation. In a case involving a landfill project, a mediator was appointed. The Board's assumption was that many of the issues could be resolved through mediation and that it should review only the most contentious issues. Although the parties had agreed to participate in the process at the time of Emond's report, the process had just begun.

Under the EARP process, pre-hearing conferences have been held in some reviews to discuss the procedures and agendas of the review. Such conferences are an opportunity for mediation. (Emond, 1985: 58) For example, immediately prior to the Beaufort Sea EARP hearings, a Pre-Hearing Conference was held in part to discuss a detailed agenda for the public hearings. The detailed agenda was a list of key issues. The public was invited to comment on the agenda and suggest changes. Such conferences could be useful forums for discussing key issues and the priority which should be assigned to each.

The Beaufort Sea panel also used a type of mediation to discuss oil spill risks. Several weeks prior to the hearings, several meetings were held to discuss methods for analyzing oil spill risks. These meetings involved the proponents, an intervenor (Environment Canada), a technical specialist and the present writer (as a member of the panel secretariat). The meetings were useful in evaluating the importance of various types of oil spill risk and in designing an appropriately-framed study strategy to assess these risks.

Pease and Smardon (1984) describe the successful use of an "independent scoping coordinator" to chair EIA scoping meetings. The coordinator was an expert in small group dynamics, technically proficient in EIA and not affiliated with the proponent agency. A balanced group of spokesmen from various groups was chosen so that no one group dominated. Government agency experts were also included. The 30 to 40 participants were subdivided according to their interests to discuss various issue areas. These subgroups met as necessary to discuss, debate and resolve conflicting opinions. The authors concluded this approach was a successful scoping exercise.

Comments

Environmental mediation has potential value for both the identification and evaluation functions of scoping. In mediation, each party identifies the issues about which it is concerned. This assists in the identification of concerns. However, important concerns which are not perceived as such by either side (e.g. due to ignorance) may be overlooked. Therefore, mediation is not a complete method of identification.

In mediation, negotiation is the basis for evaluating which issues are most important. (Grima, 1985) Scientific evidence and arguments may be used to support positions. However, unless care is taken, stronger parties can dominate and affect the results of the scoping. (Wolfe, 1982a: 30-36)

Mediation also raises a number of process questions. (Emond, 1985: 57-58) How can a mediated agreement on key issues bind those not party to the mediation? Also, if a hearing is necessary for those who are not party to the mediation, what advantage is there to mediation? Can the mediator's private negotiating room replace an open public meeting as a forum for scoping?

This review only touches on the literature on mediation. In many EIAs, there are issues which are not assessment issues so much as negotiation issues. In fact, some issues may be more appropriate for mediation than EIA. (Dorcey, 1985; Greene, 1986; Thompson, 1986) Mediation therefore deserves further study.

6.6 MODEL BUILDING WORKSHOPS

Model building workshops are another group method suitable for identifying and evaluating issues for scoping. Model building workshops are held with a goal of designing a conceptual or simulation model. It is discussed here as an example of a group process which attempts to achieve a multi-disciplinary integrated view of the issues using a model as a focus. This contrasts with previous methods which attempt to identify or evaluate disaggregated issues and with mediation which negotiates positions.

Model building workshops are usually associated with the Adaptive Environmental Assessment and Management (AEAM) method discussed in Section 4.8. The process is coordinated by a small core group consisting of i) trained analysts familiar with modelling and small group dynamics and ii) specialists familiar with the subject matter being investigated. The core group first meets in camera to outline the nature of the issues, obtain a preliminary understanding of the issues, plan a first workshop and choose participants for the workshop.

The first workshop includes both disciplinary specialists and decision makers. Its goal is to develop an understanding of the environmental systems being investigated. To focus thinking, the workshop concentrates on building a conceptual or computer model of how the system works. This forces participants to think about relationships among issues and environmental systems.

Part of the first workshop process is a technique referred to as 'looking outward'. Specialists from various disciplines are asked to identify what information they need from other disciplines to predict how the sub-systems covered by their own discipline will react to a project. This forces specialists to consider what information they need from others, and, in turn, to provide judgment or information to others. In the process, information deficiencies are identified and issues highlighted.

After the first workshop, a period is allowed for participants to study unresolved issues. Results of these studies are forwarded to the core group, which attempts to modify the model to accommodate new information. A second workshop is then held. At this workshop, the participants review the working model and the model is explained to individuals not involved in model design.

A more thorough description of the workshop process is found in Holling (1978: 11-16, 43-44, 48-56, 108-109) and Jones and Grieg (1985). This process has been tested successfully in several environmental management situations, but not in an EIA context. (Jones and Grieg, 1985) However, modelling workshops have been successful in the identification and evaluation of issues, which suggest they could be useful for these functions of scoping.

Comments

Modelling workshops are a means of bringing experts together and getting them to look at issues in a systematic and multi-disciplinary way. As a method of issues identification, they rely on the input of scientists and decision-makers. This may result in a narrower identification of issues from the scientific and bureaucratic perspectives, although

presumably interest group spokesmen could be involved in the process. The process of model building and simulation may be a bit esoteric for this context.

The strength of the modelling workshop is in the conceptual way of evaluating issues. It builds a model with the benefits discussed in Section 4.7. It does this by combining the knowledge of various specialists through a process which encourages an integrated view of the issues. In this way, it is a group method which differs from brainstorming, Delphi, and NGT which evaluate a list of issues without systematically exploring how these issues are related to the environmental systems being studied. Thus model building workshops are an important method for scoping.

7. FOCUSING - THE ORGANIZATION AND COMMUNICATION OF ISSUES

Environmental impact statements have been criticized for using a catalogue style of presentation which does not facilitate public review or decision making. Key issues are not highlighted but scattered throughout the text - simply collated into sections of the EIS based on an academic discipline where they appear to fit. (see Sections 2.0 and 7.1) To improve this situation, information conveyed in an EIS should be organized and communicated in a way that reflects the needs of the end users of the analysis - the public and the decision-makers. (Beanlands and Duinker, 1983: 94)

A related criticism is that many studies are pursued without a clear study strategy or framework. EIA studies often do not systematically focus on a set of manageable and relevant concerns, and there is often no central conceptual or analytical theme to guide data collection and impact analyses. (Beanlands and Duinker, 1983: 19, 31, 57, 71-76, 94, 107, 111)

Because of these problems, this paper defines organization and communication of key issues as a key function of scoping. The purpose of the focusing function is to organize the issues in a way that provides a coherent, integrated view of the issues. The first scoping function (identification) identified a long list of unevaluated concerns. The second scoping function (evaluation) processes the long list to single out the key issues. These two functions produce a random list of key issues. The focusing function imposes order on these key issues, sorting them into categories that provide an integrated and coherent view of the overall impact of a project. The issues are then carefully stated (formatted, defined) so they can be studied in a scientifically appropriate manner. Where the first two scoping functions require creative and judgmental methods respectively, the third scoping function requires methods which integrate and synthesize. This section reviews three aspects of the focusing function: categorizing and clustering, defining issues, and designing a study strategy.

7.1 CATEGORIZING AND CLUSTERING ISSUES

As noted above, the typical EIS is organized in a catalogue format. In the catalogue-type EIS, environmental effects are first classified into physical, biological and socio-economic categories. Next, these categories are broken down by discipline, e.g. physical oceanography, geology, fish, mammals, economics, culture. This organization of an EIS reflects methods often used in the EIA upon which it is based. Most checklist and matrix methods, for example, use some list of standard categories, often adapted to a specific project type (e.g. hydro dams, pipelines). (Fisher and Davies, 1973: 211-212; Dooley, 1979) While it was difficult to find discussions of what rationale was used for these categories, they appear to be based on some level of functional analysis, e.g. Leistritz and Murdock (1981). (Johnston, 1977) In some cases agencies prepare standard lists of issue categories for use within their area of jurisdiction. (Munn, 1979: 23-24)

There are two problems with the standard impact categories approach. The first problem is that these categories are difficult to use in a public forum. If issues are stated in standard categories, a citizen must often search for discussion of a single concern under several different categories. For example, Inuit concerned about the effects of tanker traffic on their culture might be required look at one set of analyses to see how tankers generate noise or leave open ship tracks in the ice cover under certain conditions, go to another place to find a discussion of how this affects wildlife, and go to still another place to find an analysis of how all of this affects the economics of hunting, and subsequently the traditional lifestyles and culture. Meanwhile, Inuit would be required to do a similar set of

searching to find evidence of the effects of wage employment on the economics of hunting and the available time and skills to pursue traditional hunting activities. (Marshall and Wolfe, 1986) The clustering by discipline thus conflicts with the more holistic perspective needed for a public review. By similar analysis, it is clear that the decision-maker would have the same difficulties in evaluating policy decisions.

The second problem with the standard categories approach is that real world environmental systems do not organize themselves by academic discipline. In the standard categories approach, effects are often assumed to travel in chains from physical, to biological to social. In fact, many effects can travel from social to biological or physical, e.g. people move to a region in anticipation of a development and begin to put pressure on fish and wildlife resources. In addition, there are many sub-systems in which physical, biological and social processes interact in complex integrated ways. Thus the standard categories in which issues are reported tend to fragment both the environmental analysis and the EIS report. A better approach is to define issue categories in clusters which reflect a more complete model of the environmental system. (Wolfe, 1982b; Marshall and Wolfe, 1986)

To avoid this fragmentation of issues, some writers suggest defining categories from the perspective of the concerned public. Bendix (1984) suggests that issues that are controversial [of considerable interest to citizens] should be the basis for categorizing impacts. Larwin and Stuart (1976) recommend that impact categories be developed out of an analysis of public goals and objectives derived from a public participation process. Thus the issue categories used in each assessment would be tailored to that assessment. This approach has been referred to as issue-oriented or issue-focused assessment. (Johnston, 1977; Priester and Kent, 1981; Marshall and Wolfe, 1986)

In a similar vein, McAllister (1980: 73-74, 266-270) suggests that categories be selected for the purpose of communicating information clearly to citizens and decision-makers. A useful way of doing this is to link categories to visible ends of human action such as the preservation of life, health, security and justice. McAllister argues this would be preferable to organizing categories around technical categories such as dissolved oxygen, particulate matter and geology which only experts can link to human ends. McAllister further argues that it is also important to link end effects to specific groups within society so that the distributional effects are clear.

Some writers argue that impacts must be clustered into categories based on both social and scientific criteria. Marshall and Wolfe (1986), for example, used dual criteria for "clustering" issues. First they applied a "social criterion", i.e. issues were defined from the perspective of affected interests (in the above example this would be the Inuit). The second criterion was "the relatedness of effects", i.e. issues should be causally related. To determine causal relations, they used a simple network approach. The two criteria were used to cluster many related minor impacts into larger clusters to be explored collectively rather than as isolated impacts. This is similar to the recommendation of Johnston (1977) who recommended that impacts be grouped into "high-level categories" which aggregate impact topics in a coherent way, politically and scientifically.

There are a variety of ways to develop clusters of issues which are politically and scientifically coherent. One approach, described in Section 4.8, is the approach used in the Beaufort Environmental Monitoring Project. It used an impact model to explore how various "valued ecosystem components" (VECs) might be affected by project activities. Because the VECs are defined by their importance to users (in this case the Inuit), the method is one way of merging socially and scientifically appropriate categories.

7.2 DEFINING ISSUES

Before key issues can be addressed they must be clearly stated. If issues are not clearly defined or stated before analysis, the analysis degenerates into the fuzzy thinking that characterizes many EISs. As Lang (1981: 90-91) states

> "...the average EIS is replete with fallacious arguments of the kind presented in any standard text on the subject: circular reasoning, question-begging, over-generalization, appeal to the authority of jargon, irrelevant authority."

Typically, instructions for preparation of an EIS are provided in guidelines which identify lists of information that must be provided in the EIS. Often the reasons why certain information is needed is not specified. This leads EIS authors to throw in whatever is available, whether or not it is relevant to a concern of the public or decision-makers. This leads to a lengthy descriptive background with no focus on concerns which may be relevant to the assessment.

An alternative procedure for communicating issues is to use a "question format" which begins with key issues (or issue clusters), and asks questions to elicit information relevant to these issues. The questions should ask for analysis that can be used to understand and evaluate the issues. In the question format, this analysis must be explicit because the reasoning can be compared to the original question. In the question format, the scoping guidelines provide a list of questions to be answered by the EIS. (Sachs and Clark, 1980: 58-59; Wolfe, 1982b; see also Beanlands and Duinker, 1983: 57) The advantage of this approach is that rather than focusing on information required, the guidelines state what questions need to be answered to evaluate a particular effect. The difference is subtle, but important. At the scoping stage of EIA, Sachs and Clark note that this format shows an awareness that "raising questions, not supplying answers is one predominant purpose of a meaningful scoping process".

Haug et al. (1984a; 1984b) present another very useful format for defining issues. It consists of a set of worksheets which force assessors to be explicit in their definition of issues being considered. Columns on the worksheets provide a framework for ensuring that the details of a potential impact are clearly spelled out, along with any assumptions or judgments which affect the identification and evaluation of the impact. For each impact, the worksheets require the identification of the change agent (project action), direction of the change (plus or minus), an indicator used to measure the change (visual quality, habitat), an estimate of the quantity of change (acres of habitat), an estimate of the probability of the change occurring, and a statement of the context (an evaluative statement of why the impact is or is not important). The worksheet approach can be extended through the use of a set of questions in a second worksheet which evaluate who is affected and how. (see Section 4.6) The U.S. Bureau of Land Management has found the worksheet approach easy to use and effective.

The development of impact hypotheses is another format for stating possible project effects. This approach is recommended by several authors. (Beanlands and Duinker, 1983: 6-7, 29, 85-87, 94; Richardson, 1983; Whitney and Maclaren, 1985; Everitt et al., 1986) A hypothesis is a testable statement of how a specific project action (or primary effect) might affect a valued environmental component. A hypothesis is formulated on the basis of conceptual modelling, networks or matrices. It is then operationalized and examined in the prediction stage of the EIA. Since the setting of hypotheses is a basic scientific procedure, this approach has obvious benefits for the framing of appropriate research strategies.

A possible concern with the hypothesis approach is that some effects that may not be amenable to scientific investigation may still be relevant to impact assessment. An example is the assessment of visual impact. The decision-maker must be sure that all important effects are considered, not just those effects which can be formulated into scientifically testable hypotheses. Thus some other format for expressing non-testable issues may be needed. These non- testable issues will involve some form of subjective evaluation. It was recommended earlier that whenever subjective evaluation is a major component of the analysis, subjective judgments must be made explicit and affected interests must be involved in the evaluation.

7.3 DESIGNING A STUDY STRATEGY

A clear, well-planned study strategy is important to the quality of an EIA. It is debatable, however, whether the design of this strategy should be part of the scoping undertaken by an initiating agency or review panel, as scoping is defined in this paper. The development of a study strategy takes the input from scoping and frames this input into appropriately-framed scientific studies. This type of work should probably be done by the team conducting the EIA. However, it is discussed here because it is in the grey area between scoping and EIA analyses.

The lack of a study strategy is problematic for an EIA. Tanaszi (1981) describes a case where no clear study strategy guided an EIA for a new road to a northern Ontario mining project. She found that

> "There is little, if any, evidence in the guidelines of a controlling concept which could shape the final product. In other words, there is little guidance for determining what the assessment is supposed to show, prove, explain, relate, evaluate..."

Beanlands and Duinker (1983: 31) found in their review of 21 Canadian impact assessments and in workshops with practitioners that most assessments lack clearly recognizable study designs or strategies. This means that there was no central conceptual or analytical theme to guide collection of data. The lack of a well thought-out study design complicates the effective deployment of time and resources in the study. It also fails to ensure that appropriate questions are answered with the best available scientific understanding. This means that the analysis may not relate effectively to the decision-making purpose of EIA (making decisions concerning project approvals and mitigation).

To ensure that these concerns are addressed, a clear study strategy should be developed which identifies the questions that need to be answered, the studies that should be done to provide these answers, and the persons who should do these studies. This will allow the assessment team to allocate research time and budgets more effectively and ensure that the studies conform to decision-making requirements. It will also ensure that cooperating agencies, intervenors and other participants know what is being done so that they can be prepared to participate in the review of study results.

The study design should include some built-in quality controls to ensure that the information provided by the EIA meets adequate standards of acceptability. Beanlands and Duinker (1983: 3, 41-42) suggest that some means of external scientific peer review should be built into EIA procedures to ensure that scientific and technical work is conducted in an adequate fashion. This includes an evaluation of whether appropriate scientific standards have been applied in studies supporting the assessment.

In defining what a study strategy should include, Beanlands and Duinker (1983: 94) recommend that

> "Environmental impact assessments should be required to develop an explicit strategy for investigating interactions between a project and each valued ecosystem component, and to demonstrate how the strategy is to be used to coordinate the individual studies undertaken."

This strategy would be based on a conceptual understanding of environmental systems and how the project might affect valued components of these systems. It should examine direct and indirect methods for measuring these. Finally, it should design detailed studies to implement the study strategies.

Given that EIA in Canada is a process involving a review body (panel or lead agency), proponents, cooperating government agencies, and the public it is necessary to decide who should develop a study strategy to the extent described above. In a self-assessment process, the proponent prepares the EIS. How far should the review body and others go in defining 'how' this study should be done? Should the public be involved, and if so, how? In a management-by- objectives world, the answer would seem to be that the review body would clearly specify what results (answers) are required, and the proponent would be left with the flexibility to frame a study strategy to achieve those results. If this is so, then to what extent would the review body be involved in reviewing the study strategy? How should this be done? How would the work of proponents be integrated with the input of cooperating agencies and the public, who in many cases provide important scientific evidence and studies to the review body? These questions are critical because the acceptability of the EIA to the public and the decision maker may depend on whether the study designs produce answers that answer their questions.

The questions above must be discussed before study strategy requirements can be fitted into the EIA process in Canada. The development of a study strategy is the link between scoping and EIA analyses. It is an important transition which may well determine how effective the EIA is. This is an important area for further thinking.

8. CONCLUSIONS

This literature review was based on a definition of scoping consisting of three functions:

i. Identification of concerns of the public and scientists.

ii. Evaluation of these concerns to focus on the key issues (and to eliminate issues which are not significant).

iii. Organization and communication of these issues in a form which assists the analysis of issues and the ultimate making of decisions.

While several methods can accomplish these functions, no single method was found which would adequately scope environmental reviews in all situations. For simple project assessment situations, methods such as filtering questions (see Section 4.2) or worksheets (see Section 4.3) might offer an appropriate overall method if used properly. In other more complex projects, a variety of methods would be required as part of a scoping process. For example, various methods could be used to involve affected interests (see Section 5.0) or involve scientists or citizens in scoping (see Sections 6.0). Meanwhile, technical experts might use traditional EIA methods to identify and evaluate possible issues. (see Sections 4.0)

For issues identification, a satisfactory range of methods appear to be available. No one can ever be sure that all possible impacts have been identified because ultimately this identification depends fundamentally on our understanding of environmental systems, which is often poor. However, for more complex reviews, some form of 'triangulation' process may be appropriate. Triangulation means using several methods to identify issues and comparing the results. In the case of a publicly accountable process, it is essential that this triangulation involve the use of methods which identify public concerns as well as scientific and technical concerns.

For the evaluation of which issues are most important in an EIA, it has been noted that value judgments are inevitably required. It was recommended that when this evaluation is undertaken (1) all value judgments should be made explicit, and (2) affected interests should be involved. Very few evaluative methods are available which accomplish this. As a result, triangulation may be especially necessary in evaluation. In addition, a major effort should be made to clarify the criteria which governments (and societies) expect to have applied in environmental evaluations.

Given that identification methods are better developed than evaluation methods, it would be useful to direct more attention to the evaluation and organizing/communicating functions. It is in these areas that the critical decisions of what to highlight or exclude from an EIA are made and the study and review strategies planned. This is the area where scoping is likely to be most controversial for affected interests. Methods for evaluating issues must achieve some level of consensus among all parties as to the importance of the issues. Existing identification methods can be tested in management experiments and refined. However, better developed, more usable evaluative methods need to be developed and tested.

Appendix A

SCOPING CRITERIA

The use of scoping criteria was discussed in Section 3.2.2. Scoping criteria are standards by which an assessor can judge whether an environmental issue or impact is important. This appendix reviews some of the criteria proposed in the literature.

1. LEGAL AND POLICY CRITERIA

Government policies for resource management are stated in legislation, regulations and policy statements. These policies often include regulatory standards for water quality, effluent discharge, noise disturbance, air pollution emissions, and similar environmental matters. (Haug et al., 1984b) National environmental standards and policies are sometimes stated in regulations. Government policies provide one criterion for evaluating the importance of issues.

2. FUNCTIONAL CRITERIA

Functional criteria are based on the premise that if natural environmental systems are not maintained, the environment upon which people depend for air, water, food, and livelihood will eventually become permanently degraded and less productive. This may result in declines in overall environmental quality and losses of renewable economic resources to the detriment of present and future generations. (Haug et al., 1984b)

Functional criteria thus consider factors which relate to how much environmental systems are changed by project actions. Functional criteria include the magnitude of the effect (how large it is), geographic scope or extent of the effect (how large an area it affects), duration (how long the effect lasts), frequency (how many times it happens), intensity (how severe the effect is on the environmental system), risks (what the chance is of the effect occurring), mitigation (whether there are ways to reduce or avoid the effect) and reversibility (whether the environmental system may eventually recover and how soon). (FEARO, 1978: 6; Ahmad and Sammy, 1985: 11-12; Henshaw, 1984)

Functional criteria are often difficult to establish, since environmental systems behave differently. Some areas or resources may be especially sensitive to the effects of development. These may include biologically unique areas (e.g. sensitive bogs, erodible alpine tundra, scenic deep forests); or functionally important areas (e.g. forest edges, riverside habitat); or economically important areas (e.g. the habitat of hunted deer, merchantable forests). (Henshaw, 1984) Environmental sensitivity may also differ regionally, e.g. air pollution is a major concern in large cities; erosion is a serious issue in the Sudano-Sahel. (Ahmad and Sammy, 1985: 11-12)

There are complications in the application of functional criteria. First, it is difficult to judge how large a change in the environment must be before it should be considered serious. Second, there are major difficulties in measuring how much change is actually occurring in the environment, given natural variations. (Matthews, 1975; Baker et al., 1977: 93-96; Beanlands and Duinker, 1983)

Despite these qualifications, functional criteria are useful when considering the importance of the effect. Whenever judgments must be made about environmental impacts, variables such as suggested by functional criteria must be part of the analysis. Thus other types of criteria depend on functional analyses.

3. NORMATIVE CRITERIA

Normative criteria are based on the values society places on certain environ- mental features or qualities. People often hold clear values about what levels of impact would be acceptable. These values are often highly subjective and individual, and may not necessarily relate to functional considerations such as those discussed above. They are often based on social or economic concerns. (Haug et al., 1984b) Because scoping is partly a socio-political process, consideration of normative criteria will be important in scoping processes. Normative criteria can be expressed as (a) general principles, (b) specific community environmental goals or (c) publicly valued environmental components.

a. General Principles

General principles state what aspects of a project should be considered important based on the society's values. For example, Beanlands and Duinker (1983: 45) and Duffy (1986: 16) indicate that society may be most concerned about those features of a proposal which would:

a) affect human life, health or safety,

b) undermine or eliminate the way people earn a living,

c) cause the lifestyles of people to be modified,

d) affect recreational, aesthetic, educational, scientific or historical features and the preservation and conservation of natural areas,

e) involve conflicting alternatives for the use of land, and

f) affect the balance between the supply and demand of resources and their development within a local, regional or national context.

These criteria can be compared with the effects of a project to determine if these effects are significant.

b. Community Environmental Goals

Community environmental goals are explicit statements about the positive features of the environment that a community wishes to maintain. They become criteria for project planning: proponents can use their ingenuity in designing projects to accomplish them. This approach has been tried with success in land use planning, where rigid standards and zoning codes have been replaced in some jurisdictions by "performance criteria". (Veitch, 1978: 55-60) (see also Section 4.6)

Larwin and Stuart (1976) describe an example of the use of community goals in the planning of a highway. A set of 10 goals and objectives was developed through a participation process involving citizens living along alternative highway alignments. The goals and objectives were used in a planning and assessment program for the identification of key environmental issues.

Andrews et al. (1977) argue that efforts should be made to identify national environmental values and goals for environmental decision-making. Scoping decisions could be improved if national environmental policies were stated in a form that would assist in developing scoping criteria for evaluating issues.

c. Publicly Valued Environmental Components

"Publicly Valued Environmental Components" (PVECs) are environmental ends or goals that the public would like to see maintained or enhanced, such as beautiful landscapes, unspoiled recreational resources, rising property values, and healthy work and home environments. They are thus very similar to community environmental goals. A PVEC indicates both a specific component of the environment and the socially-desired attributes of that component. PVECs are identified through a "social scoping" or public involvement process. (Maclaren and Whitney, 1985) PVECs can be both socio-economic and biophysical components of the environment.

PVECs are an extension of the "valued ecosystem components" (VEC) concept developed to assist with biophysical studies. A VEC is a biophysical component of an ecosystem (important species or biophysical process) that is valued by society. VECs are chosen through a social scoping exercise. (Beanlands and Duinker, 1983: 65-67; Truett, 1979) Once identified, VECs become the focus of subsequent environmental investigations. Scientists develop environmental models to help determine how VECs could be affected by a project. (see Section 4.7) Thus the VEC becomes a focusing point, or criterion, for deciding which issues are significant.

4. CONTROVERSY

There is some debate about whether an issue should be considered important because it is controversial. Some advocate that if an issue is controversial or a source of conflict between various individuals, advocacy groups, or organizations, it should be considered important whether or not it is significant for other reasons. (Haug et al., 1984b; Rau and Wooten, 1980) Others argue that controversy may or may not be a reason to judge a concern as significant; rather, controversial concerns must be listened to and weighed by the assessor. (Baker et al., 1977: 93-96; Mygatt, 1984)

Controversy may relate to the type of project or impact being evaluated: some projects (e.g. nuclear, landfills) are inherently controversial. Controversy may develop because people do not want a project built; in such cases, controversy may mean normative criteria are violated by the development.

Controversy can also arise because scientific analysis are in dispute, or the nature and quantity of environmental effect is uncertain. Scientific analyses may be unanimous in concluding, for example, that a certain effect will not occur; the public may not accept these conclusions.

Appendix B

IDENTIFYING AFFECTED PUBLICS

To obtain a representative view of the concerns of the affected public, it is essential that all sub-components of the general public be identified. The public is not a singular entity, but a diverse collection of "publics". These publics include individuals, groups, politicians and other interested parties including scientists. They also include the staff of government agencies, who represent the public in their capacity as managers of public resources and programs. (Willeke, 1981; Whitney and Maclaren, 1985: 4-8)

The identification of affected interests was listed as one of the attributes of scoping in Sections 2.2 and 5.0. Several methods are available for identifying publics:

1. Self Identification.

   - Mailing Lists. Develop mailing lists of persons who identify themselves by writing letters or briefs, signing petitions, writing letters to newspapers, speaking to the issue at hearings, or making themselves visible by other means. (Willeke, 1981; Whitney and Maclaren, 1985: 4-8)

   - Advertising. Using advertising to notify the public of the intention to review a project, providing details of how to contact the review agency. Notification is frequently limited to Notices of Intent filed in a government gazette. However, because government gazettes are not widely read by the public, this is not an effective way to reach the wider public.

2. Third Party Identification.

   - Field Interviews. A useful approach, referred to as the snowball technique, is to contact persons who are known to be interested in the project or knowledgable about the local political context and ask them to identify affected persons or groups. These persons and groups are then contacted to identify further affected parties. The process continues until relevant persons and groups are identified. (Sproule-Jones and Richards, 1984; Willeke, 1981)

   - Citizen Advisory Committee. A citizen advisory committee can be asked to identify relevant individuals or groups. (Willeke, 1981)

3. Staff Identification.

   - Identification by Location. Identify persons living near the proposed project who might be affected by the project by examining maps and directories. (Willeke, 1981; Whitney and Maclaren, 1985: 4-8)

   - Analysis of Associations and Organizations. Use of interest group memberships, mailing lists, and demographic analysis. (Willeke, 1981; Whitney and Maclaren, 1985: 4-8)

   - Historical Analysis. Reviewing correspondence files of the agency, hearings transcripts of related projects, and newspaper accounts. (Willeke, 1981)

Another approach which deserves some consideration is the development of joint mailing lists or clearinghouses. Sachs and Clark (1980: 49) describe the "network" established in New York referred to as a clearinghouse which greatly assisted in the identification of state agencies with a relevant interest in various types of project. In a similar case, North Carolina developed a statewide list of people interested in permitting actions, including contractors interested in new construction, environmentalists, concerned yet unaffiliated citizens, and county, state or federal officers with relevant jurisdictions.

Appendix C

MIXED SCANNING

Etzioni (1967) introduces a concept of "mixed scanning" to describe an approach for focusing decision-making on important issues. This approach, while not an EIA scoping method per se, may be a way of improving the context for scoping.

Mixed scanning involves a two stage approach to problem analysis. Etzioni uses the analogy of a weather satellite used to predict hurricanes to illustrate the approach. The weather satellite would use two cameras:

> "a broad-angle camera that would cover all parts of the sky but not in great detail, and a second one which would zero in on those areas revealed by the first camera to require more in-depth examination."

Although mixed scanning is more a strategy than a method, the reader will note that the concept is identical to that of scoping - to get the big picture sufficiently clearly so that the key issues can be investigated more carefully and efficiently. Environmental assessment processes are often criticized for considering development on a project-by-project basis which overlooks the cumulative effects of numerous projects. Adopting the mixed scanning framework allows a project to be considered in context with other projects and allows a closer, more focused look at the individual project itself.

Three approaches are available to implement the mixed scanning concept: regional assessments, regional planning, and tiering.

Cooper and Zedler (1980) suggest an approach using a regional ecological assessment process to map ecologically sensitive areas in a region. (see also James et al., 1983) These maps display baseline information for reviewing all projects in the region in their regional setting. The maps should be of sufficient detail to provide project planners, environmental assessors and the public with a clear, if qualitative, idea of the nature, distribution and abundance of ecological resources. They identify and describe, in detail, areas of ecological sensitivity. They should facilitate access to scientific literature, highlighting neglected areas of scientific knowledge. They should be able to incorporate new information. Once complete, some method of certifying the database as an acceptable basis for planning and assessment is required. Agreements should be established defining who organizes and pays for the development of the database.

The concept of resource inventory mapping is not new. Extensive mapping is available from the Canada Land Inventory and other agency data bases. The difficulty is that this data is not often not organized and integrated in a fashion which would support impact assessment. However, it could be. To do so, databases should incorporate some analysis of how environmental systems would be affected by a range of development possibilities. One means of doing this is to develop ecological models which identify critical environmental processes and investigate how they function. There is now a wide range of literature describing such models and considerable experience with application. (Holling, 1978; Jones and Grieg, 1985; Fritz and Rago, 1980; States et al., 1978; Valiela, 1984; Walters, 1975) A major effort has been made in modeling environmental systems in the Beaufort Sea through the Beaufort Environmental Monitoring Program. (Everitt et al., 1986)

To be helpful for EIA scoping, such models should be organized long before EIAs are contemplated. This would allow the development of focused and meaningful programs for ongoing resource inventory work in government agencies. As EIAs are undertaken, these databases would at least serve as a partial substitute for baseline description in the EIA. In turn, EIAs would be designed to contribute further descriptive or functional information to the database.

A second mixed scanning option for environmental analysis is to integrate EIA and regional environmental and land-use planning. (Richardson, 1983; Boothroyd, 1980: 19-22) It has been argued that EIAs should be prepared in the context of regional objectives and natural resource policies for a region. The basis for establishing such objectives and policies is the process of regional planning. To be of value for EIA, this planning should incorporate analysis of environmental systems and resources. The methodology for doing this is available. (Veitch, 1978). Regional assessments, as suggested above, would provide an excellent database for this planning as well as EIA.

A third mixed scanning approach is the concept of "tiering". (Boothroyd, 1980: 14-19) Tiering was introduced in the United States as a part of the 1978 CEQ EIA streamlining regulations. According to the regulations,

> "Agencies are encouraged to tier their environmental impact statements to eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision at each level of environmental review...." (CEQ, 1978, Sec. 1502.20)

In the United States, EIAs are prepared to evaluate the environmental effects of whole programs and policies of government departments. Once an assessment has been completed at this macro-level, assessments of the effects of component projects can be more streamlined since broader issues have already been addressed. At the same time, key issues for project reviews may be partially identified at the macro-level. Some issues might also be eliminated from detailed consideration at a project level. For example, a program level assessment might determine that certain effluents from offshore drilling (e.g. domestic wastes) were of concern only in certain situations (e.g. nearshore or confined waters). At the project assessment level, discussion would not need to be recycled on this issue, except where local circumstances vary with the assumptions in the macro-assessment. This would result in a more tightly scoped project assessment and reduce repetitive discussions of the same issues.

As mentioned above, mixed scanning is not a scoping method, but regional assessment, regional planning and tiering would link resource management analyses in a way that would greatly assist the scoping of EIAs.

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